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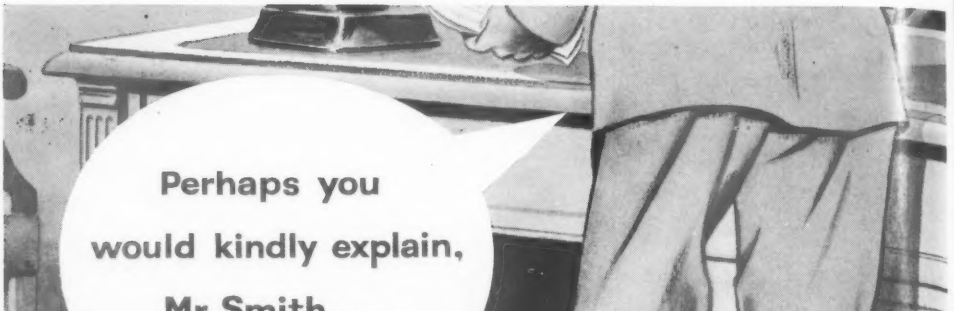

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FOUNDRY TRADE JOURNAL

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Industrial Design

Possibly owing to television publicity, there was a small queue to enter the new Industrial Design exhibition which has been opened at 28, Haymarket, London, W.1. No better location could have been found, or have exhibits ever been shown to better advantage. Just as an invention is worth but little until it is being made by the working man, so the best industrial designs are but of academic interest until they can be inspected by a cross-section of the populace. Whilst one can see a representative selection of hardware at the large stores, and stoves and the like at the Building Centre, here in Haymarket are supposed to be samples of the best that is available. By and large, the organizers—the Council of Industrial Design—have been successful in their choice of what to show.

The products of the foundry industry are shown in the basement. Here are cooking and heating stoves, washing machines of several types, food mixers, and kitchen utensils. One black-finished stove looks completely out of place in this collection, but it may be that it is there because its technical efficiency outweighs perfection of finish. The kitchen weighing machines call for unstinted praise both for finish and colour, but why the stacks of weights are lopsided, show surface porosity, flash, and general bad finish, we really cannot imagine, unless it be a gesture to that—to us—incomprehensible factor "contemporary idiom."

There is nothing unique on show in this exhibition, as each item finds its place in large stores, the West End shops, or industrial showrooms. Yet the exhibition in itself is unique, as it does, as claimed, represent the best or the newest products of British industry, and the method of display is excellent. For the initial success to continue, the show must be dynamic. New designs have often to prove their real worth, and should they fail or possess merely a passing sales appeal, they must be ruthlessly replaced. The aim of the Council should be to bestow a cachet of good design and workmanship on any article they accept for exhibition. With many lines of goods there is little change in design other than slow evolution over quite long periods, and because of this, such items should be retained longer than those that represent rapidly-changing fashions. Unlike other exhibitions, quite often the name of the designer of an article is quoted. This is all to the good, as it enables manufacturers who are envisaging changes to find a person who does make an appeal to public taste. We counsel all founders who make goods for sale to the general public to visit this new exhibition, for we have faith that it will become a permanent feature in the sphere of selling British goods at home and abroad.

Iron & Steel Institute Awards

The following medals and prizes will be presented at the annual general meeting of the Iron and Steel Institute at the Royal Institution, Albemarle Street, London, W.1, on the morning of May 16, by the retiring president, Sir Charles Bruce Gardner, Bt.

Bessemer Gold Medal for 1956

To Dr. Charles Sykes, F.R.S., (Thos. Firth and John Brown, Limited) in recognition of his distinguished contribution to the study of alloy systems, particularly in the field of order/disorder changes and the effect of such changes on the physical properties of alloys.

Sir Robert Hadfield Medal for 1956

To Mr. Henton Morrogh (British Cast Iron Research Association) in recognition of his distinguished contribution to the study of the metallography of cast iron, and for researches which resulted in the discovery of nodular iron and the improvement in the quality of cast iron.

Additional Williams Prize for 1954

Jointly to Mr. F. A. Gray and Mr. S. A. Brooks (Appleby-Frodingham Steel Company, Limited) for their paper on "An Investigation of Re-heating Furnace Design and Performance," of which they were the joint authors.

Williams Prizes for 1955

To Mr. A. J. Kesterton (Steel Company of Wales, Limited) for his paper on "Some Starting and Operating Experiences at Abbey Melting Shop," presented before the Cleveland Institution of Engineers, and to Mr. R. Wilcock for his paper on "Operation of a 60-ton Arc Furnace at Samuel Fox & Company, Limited."

Ablett Prizes for 1955

To Mr. W. Ernest (Samuel Fox & Company, Limited) for his paper on "Waste Heat Recovery related to the Generation of Electric Power"; to Mr. S. R. Phelps (Guest Keen & Nettlefolds, Limited) for his paper on "Flying Shears for Bars and Billets—Electrical Requirements," and to Mr. R. Stewartson (Guest Keen & Nettlefolds, Limited) "Flying Shears for Bars and Billets—Mechanical Design Features."

Arc Furnaces for Ingot Steel

As part of a major expansion scheme, to be completed by 1958/9, Round Oak Steel Works, Limited, a member of the T.I. group of companies, has decided to adopt electric melting furnaces to provide the increased output of ingot steel. The first stage of the scheme will cost approximately £1,000,000, and will include two large Lectromelt arc furnaces to be built by Birlec, Limited. Of particular interest is the use of electric furnaces for the first time in the United Kingdom for the production of ingots destined for structural steels. The furnaces will each have a nominal capacity of 50 tons and together will add something like 170,000 ingot tons a year to the Round Oak output, which will then total about 500,000 tons annually.

ROYAL SOCIETY OF ARTS, John Adam Street, Adelphi, London, W.1, announce that the prizes offered in connection with this year's Industrial Art Bursaries Competition have been increased by £965 and now total £3,350. The winner of the 1955 award in the domestic solid-fuel burning appliances section was Mr. D. J. Keepax of the Birmingham College of Art. Two former winners in this section are now employed as full-time designers in the industry.

National Federation of Iron & Steel Merchants

At the annual general meeting of the National Federation of Iron and Steel Merchants, Mr. W. H. Lawson, C.B.E., the independent chairman, stated that throughout the year demand for steel had, in general, exceeded supplies available from home mills. As a result large imports had been necessary at prices in excess of home prices. Representations had been made by the Federation, as well as by other bodies, to the Iron and Steel Board advocating a continuation of the temporary suspensions of import duty.

Owing to the acute world shortage of steel, it was necessary to place orders on the Continent many months in advance of the delivery dates required. Neither consumers nor merchants could afford to place firm orders with distant delivery dates, if there was uncertainty as to whether or not the duty would be reimposed before those dates, and accordingly representations had been made to the Iron and Steel Board impressing upon them the need for decisions with regard to suspensions of import duty to be announced some months in advance of the operative dates.

European Coal and Steel Community

It was understood that one of the main items for discussion, as affecting the steel trade, at the most recent meetings of the Council of Association between the United Kingdom and the European Coal and Steel Community, had been in connection with the rates of British tariffs on steel imported from the E.C.S.C. countries. In the long term, these negotiations might be of great importance to the merchants, especially if it was decided to reduce British tariffs to any considerable extent.

Correspondence

IS GREEN-SAND MOULDING DETERIORATING?

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I was interested to read Mr. Haynes's article under the above title in your issue of April 12, on the moulding process for housing beds, in green-sand. This process was in use 35 to 40 years ago, excepting for the employment of U-castings, and straight-edges. The pattern at that time was only a section of the required length.

I was also interested to read that the economics of this job will now stand the use of cover plates, as the last several I made were cast in open-sand moulds.

Yours faithfully,

W. SLATER
(Foundry Manager).

Hill View,
Tansey Green,
Brierley Hill, Staffs.
April 28, 1956.

This letter has been slightly emended—Editor.

Cardiff Conference Booklet

The handbook of the 53rd annual conference of the Institute of British Foundrymen, which is being held at Cardiff from June 12 to 15, is now being issued. It details the names of the committees responsible for organizing the meeting and then sets out in meticulous detail the times and places of the various items of the programme. Sufficient notes are given of the several works to be visited to enable members to make an intelligent selection to meet their wishes. It is unquestionably a well-balanced programme, which should prove exceedingly popular.

Dimensionally-accurate Castings*

By J. Hill

MR. HILL is now development engineer of Ley's Malleable Castings Company, Limited, which firm he joined in 1947 as mechanization superintendent. Mr. Hill was educated at Heywood Grammar School and the Manchester College of Technology. He began with apprenticeship at the Heywood Foundry Company, Limited, and Mather & Platt, Limited, being appointed assistant to the foundry superintendent of the latter firm in 1940. From 1941 to 1947 he was employed by John Gardom & Company as senior assistant. Mr. Hill is a past-president of the East Midlands branch of the Institute of British Foundrymen, an associate of the Manchester College of Technology and of the Institution of Metallurgists.

As a background to this Paper, the revolutionary developments this century in the engineering industry—advent of automobiles, planes, mass-production machinery, etc.—should be borne in mind. They have resulted throughout the period in continually enhanced demands upon founders for greater precision, special techniques and machinery for high production, new alloys, improved standards of quality and inspection. The net result is that the foundry industry needs always to be reviewing its methods, processes and equipment to see how well they meet the new demands. The present work examines critically several potent factors governing the accuracy of castings in relation to this background.

The Paper deals with the various sources of error in the dimensions of castings under the headings: Inherent contraction characteristics of the metal; mould and core uniformity; mould pressures; gating and feeding practice; equipment—machines, patterns, jigs and gauges; physical inspection; and casting design. It is emphasized that accuracy must be associated with control, but with such control it may be possible to attain an accuracy in green- and dry-sand moulding similar to that from some of the newer casting processes.

INTRODUCTION

Throughout this century revolutionary developments have been taking place in the engineering industry. The advent of the automobile, aeroplane, and the rapid development of industrial-production machinery have resulted in modern methods of mass production and machine-shop practice. In effecting these developments, increasingly exacting demands have been made upon the foundry industry for an improved product, both metallurgically and as regards dimensional accuracy of the castings. Technical development, even during the past 20 years, has resulted in major changes in production methods in large sections of the industry. Castings comprise a high percentage of the total cost of many machine tools and finished products, and a greater precision has also been demanded to meet competition from weldments, plastic components, drop forgings, etc.

Mass-production mechanized methods have been introduced which demand special techniques, and mechanical aids have been employed in an endeavour to produce quickly a more uniform and accurate product. Vast progress has been made metallurgically by the introduction of new alloys and in the supply of castings to definite physical and chemical specifications. This has been effected only by continued research and a better understanding and control of the raw materials and processes from which the alloys are produced.

Improved Standards of Quality

The improved standards of casting quality have been brought about by a similar process of research into mould and core materials; a greater understanding and control of raw materials; and increased precision in our manufacturing equipment. Although recently there have been wider developments of precision-casting processes, it is essential that founders continue to maintain, or improve on, the standards of accuracy and finish of castings produced from dry- and green-sand moulds, since these continue to be the basic methods of production for the vast majority of castings. There are few manufacturing processes where an accurately finished product is demanded which involves as many variables as the production of castings from green- and dry-sand moulds. Where these variables occur they must be pin-pointed and control established if satisfactory results are to be achieved.

There is little published literature upon tolerances which may be regarded as reasonable for all types of castings, although attempts have been made to give some authoritative statement upon the subject, and in late 1944, sub-committee T.S. 12 of the IBF technical committee[1] was formed with the following terms of reference: "To prepare an authoritative statement which will be a guide both

* Official exchange paper from the Institute of British Foundrymen to the Australia (Victoria) branch on the occasion of its annual conference.

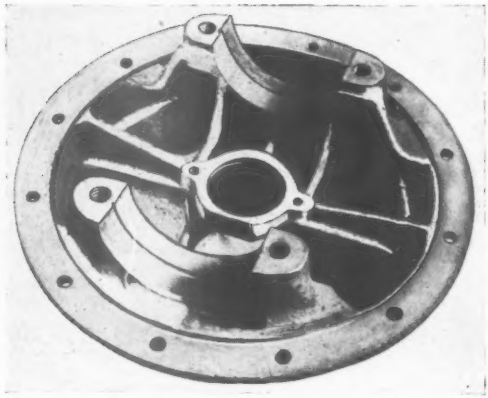


FIG. 1.—*Rear-axle housing casting, produced with the use of an oil-sand core.*

to founders and purchasers as to the tolerances which may be regarded as reasonable or allowable in all types of castings. This statement to include suitable reference to the jigging of castings." After considering the subject for nearly four years, the committee came to the following conclusions:—

(1) Although numbers of dimensions had been examined they had insufficient data upon which to make definite recommendations of the dimensions of castings.

(2) The data required would be so voluminous that there would be great difficulty in collecting sufficient information to make the final recommendations fully authoritative.

(3) Any tolerances suggested would be subject to an infinite variety of qualifications which would make the suggestions of very little value.

The report of the committee then became one of useful general considerations affecting the dimensions of castings, many of which are included in this Paper.

Control Points

It is not, therefore, intended to attempt to make any general statement upon the accuracy which can reasonably be expected, but rather to emphasize the phases of casting manufacture where maximum inaccuracies occur and where control must be established and standard conditions maintained to meet the degree of accuracy required. The degree to which the control can be economically employed varies with the type of work being manufactured, the "one-off" casting, small or large, cannot be subject to the same degree of control as the mass-produced casting and, consequently, the same degree of accuracy cannot be expected.

The ultimate size of any casting made from a given pattern is dependent upon a range of factors, the most important being: (1) Inherent contraction characteristics of the metal; (2) mould and core uniformity; (3) mould pressures; (4) gating and feeding practice; (5) equipment—(*a*) machines; (*b*) patterns; and (*c*) jigs and gauges; (6) physical inspection; and (7) casting design.

Although it is intended in the Paper to deal with each separately, it must be emphasized that each of these factors may have a direct effect upon the others and it is only by controlling each in turn that maximum control can be ensured throughout the process. In this respect, the maintenance of standard conditions is essential. Very often the introduction of new plant or materials, whilst increasing general efficiency, can have an adverse effect upon casting dimensions, if their effect upon established standards is not quickly noted and adjustments made.

INHERENT METAL-CONTRACTION CHARACTERISTICS

Linear Contraction

Although slight expansions during cooling do occur at various critical temperatures in some metals, these are rarely great enough to balance the contraction which occurs in cooling from the pouring temperature, and in general a casting is smaller than the mould in which it was cast. The extent of this contraction[2] is usually expressed as a linear function, as determined after pouring metal into a mould 12-in. long and of $\frac{1}{2}$-, $\frac{3}{4}$-, and 1-in. square cross-sections. Typical contraction constants for a number of ferrous-casting alloys are shown in Table I.

TABLE I.—*Typical Contraction Constants.*

Ferrous.	Inches per ft.	Non-ferrous*.	Inches per ft.
Grey iron, high-carbon hematite cast iron	0.140	Aluminium casting alloys	$\frac{1}{8}$
Good-quality engineering cast iron	0.158	Aluminium / silicon alloys	$\frac{1}{8}$
Steel:		Aluminium / manganese-bronzes	$\frac{1}{8}$
Light section $\frac{1}{8}$- to $\frac{1}{2}$-in. thick	0.25 to 0.27	Yellow brass and German silver	$\frac{1}{8}$
Heavy section	0.20	Tin-base white metal	$\frac{1}{8}$
Whiteheart Malleable:		Lead-base white metal	$\frac{1}{8}$
Average-hard contraction	0.255	Phosphor bronze	$\frac{1}{8}$
Annealed contraction	0.278 net		
Blackheart malleable:			
Average-hard contraction	0.23 ($\pm$0.007)		
Annealed contraction (dependent upon the carbon content)	0.141 to 0.127		

* Values determined on round bars cast in green-sand between yokes.

These data refer only to castings of standard section and unhindered contraction. If the section of the casting be less, the contraction is usually greater and *vice versa*. Where special conditions intervene, such as heavy cores or special shapes, a considerable reduction in contraction is often found. Occasionally no contraction is found, and expansion can even occur.

Figs. 1 to 5 show examples of similar blackheart-malleable castings, the moulds being made under standardized conditions. For the castings shown in Figs. 1 and 2 an oil-bonded core was used; Figs. 3

TABLE II.—*Data on Test Castings.*

Fig.	Description of casting.	Type of core.	Pattern dia.	Hard casting.		Annealed casting.		Growth on anneal.
				Dia.	Contrac.	Dia.	Contrac.	
			In.	In.	In./ft.	In.	In./ft.	In./ft.
1	Rear-axle housing	Oil-sand	17 11/16	17 5/8	1/16	17 21/32	5/64	5/64
2	Bevel-wheel housing ..	Oil-sand	15 45/64	14 43/64	5/64	15 1/16	5/64	5/64
3	Differential carrier	Green-sand	15 11/16	15 5/8	1/32	15 11/16	1/32	3/64
4	Brake drum ..	Green-sand	16 13/16	16 1/16	1/32	16 1/16	1/32	5/64
5	Solid round plate, ¾-in. thick ..	None ..	16 13/16	16 1/16	1/32	16 13/16	1/32	5/64

and 4 show castings made with green-sand cores, and for the flat plate shown in Fig. 5 no core was used. Table II shows the variation in dimensions to the nearest 1/64 in. Greater contraction can be expected as a casting contracts on to a green-sand core than on to an oil-sand core. One would expect a similar effect using a dry-sand core.

Recent Experiments

Some recent work carried out by Gittus, of the BCIRA,[3, 4] although primarily intended to show the influence of green- and dry-sand moulds on shrinkage defects in grey cast-iron, throws some interesting light upon the behaviour of green- and dry-sand moulds after the metal has entered the mould.

Experiments were conducted using a solid 6- by 4-in. dia. cylinder made in Bromsgrove Red sand containing 4 per cent. moisture and 1 per cent. pelleted pitch. With a green-sand-moulded casting, an apparent expansion of the casting occurred immediately after pouring, this expansion being absent in a dry-sand mould. It was demonstrated, by pouring the mould horizontally and vertically, using pencil gates, that the expansion of the green-sand mould could not be attributed solely to the superior resistance of a dry-sand mould to pressure.

When subject to heat, sand grains expand. Immediately after pouring, the sand around the casting is rising rapidly in temperature, and therefore expanding more rapidly than the surrounding mould. The experiment showed that in a green-sand mould the expansion compresses the surrounding colder sand and results in an increase in the volume of the mould cavity. In a more rigid dry-sand mould, the outward expansion of the sand is resisted and the hot layer expands inward. This inward expansion occurs in a green-sand mould when a layer of dry sand has been formed sufficient to resist outward expansion.

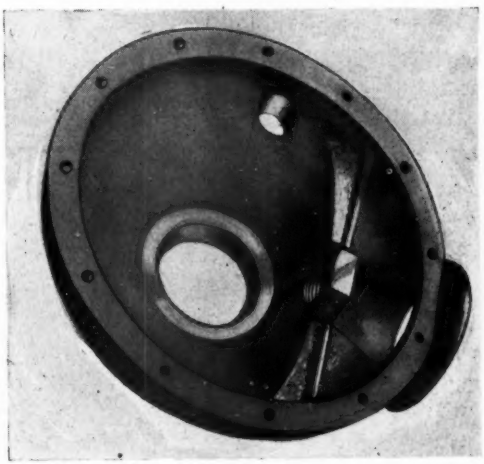
It can be assumed, therefore, that when metal is contracting on to a green-sand core, not only is the resistance less than when contracting on to a dry- or oil-sand core, but also that the mould cavity may have increased due to the nature of the sand expansion immediately after pouring, thereby introducing a further variable. If very close dimensional accuracy is required, it is necessary that the founder appreciate the general contraction allowances to make for the various sections, and also for the conditions of manufacture, but even then it may be necessary to make "trial and error" corrections based upon actual results from the casting being manufactured. Table III shows patternmakers' contractions for a number of iron alloys

Camber

Distortion of a casting can occur as distinct from ordinary linear discrepancies in size. In flat plates, beds, bed plates, etc., this frequently takes the form of a camber, *i.e.* a perfectly flat mould may yield a curved or twisted casting owing to one face cooling more quickly than the other. This type of distortion is usually not very noticable in small castings, but as the casting length increases, the distortion increases until it can exceed the machining allowance. Allowances have then to be made by imparting a distortion to the mould in order that a correctly-dimensioned casting can be obtained.

Often the amount of camber imparted is of the "hit and miss" variety based upon the founder's past experience, but a few years ago E. Longden[6] published data in the form of a graph. The graph is in two divisions, the left-hand one represents length and vertical section thickness, the right hand one depth and camber scale. It is based on the main vertical-longitudinal wall-section being 1.0 to 1.1 in. and the lower faces (as poured) carrying metal sections equivalent to 250 to 300 per cent. of the vertical sections and covering 40 to 50 per cent. of the area of the bottom face as poured. Any reduction in the vertical wall section calls for an increase in camber allowance, a thickening of the wall section requires a corresponding reduction in camber allowance. It is pointed out that camber requirements are not just an automatic increase with an increase in length as there is an acceleration in the rate of increase with increasing length.

FIG. 2.—*Bevel-wheel housing, cast with an oil-sand core.*



Dimensionally-accurate Castings

TABLE III.—*Table of Patternmakers' Contraction for Iron Alloys*[5]

Type of iron.	Type of casting and relevant data.	Contraction. In./ft.	Contraction. Per cent.	Reference.
Grey in the as-cast state, with flake graphite	< 24-in. long, uncored	$\frac{1}{8}$	1.0	1, 7, 2
	25-48-in. long, uncored	$\frac{1}{10}$	0.8	1, 7, 2
	> 48-in. long, uncored	$\frac{1}{12}$	0.7	1, 7, 2
	<24-in. long, cored ..	$\frac{1}{8}$	1.0	1
	25-36-in., cored ..	$\frac{1}{10}$	0.8	1
	> 36-in. long, cored ..	$\frac{1}{12}$	0.7	1, 7
	12- by $\frac{3}{4}$-in. square— 0.4 per cent. graphite ..	$\frac{1}{5}$	1.8	8
	2.23 per cent. graphite ..	$\frac{13}{100}$	1.12	8
	3.40 per cent. graphite ..	$\frac{1}{8}$	1.08	8
Grey iron, " high strength"	Not stated	$\frac{1}{32}$	1.3	1
Grey iron, austenitic ..	Not stated	$\frac{3}{16}$	1.5	3
20 to 35 per cent. chromium	Not stated	$\frac{1}{4}$	2.1	4
Molybdenum, cast iron ..	Not stated	$<\frac{1}{8}$	<1.0	5
1 per cent. chromium ..	Not stated	$\frac{1}{8}$	1.0	5
Ni-Hard	Uncored	$\frac{1}{4}$	2.1	6
	Cored	$\frac{3}{16}$	1.5	6
Low-nickel and nickel-chromium	Not stated	$\frac{1}{10}$	0.8	6
Ni-Resist	" Normal " size range ..	$\frac{1}{10}$	0.8	6
	" Large "	$\frac{5}{32}$—$\frac{3}{16}$	1.3—1.5	6
White, as-cast	Not stated	$\frac{1}{4}$	2.0	2
	Not stated	$\frac{5}{32}$	1.3	1
Malleable	Not stated	$\frac{3}{16}$	1.5	2
	Bar, 15 by 1½ by $\frac{1}{16}$ in.	$\frac{11}{128}$	1.4	1
	Bar, 15 by 1½ by $\frac{1}{8}$ in.	$\frac{5}{128}$	1.3	1
	Bar, 15 by 1½ by $\frac{1}{16}$ in.	$\frac{19}{256}$	1.24	1
	Bar, 15 by 1½ by $\frac{1}{4}$ in.	$\frac{9}{160}$	1.17	1
	Bar, 15 by 1½ by $\frac{3}{8}$ in.	$\frac{1}{64}$	1.04	1
	Bar, 15 by 1½ by $\frac{1}{2}$ in.	$\frac{7}{256}$	0.9	1
	Bar, 15 by 1½ by $\frac{5}{8}$ in.	$\frac{3}{128}$	0.78	1
	Bar, 15 by 1½ by $\frac{3}{4}$ in.	$\frac{1}{64}$	0.65	1
	Bar, 15 by 1½ by $\frac{7}{8}$ in.	$\frac{3}{256}$	0.39	1
	Bar, 15 by 1½ by 1 in.	$\frac{1}{128}$	0.26	1
Nodular, treated with pure magnesium	Bar, 20 by 1 in. ..	$\frac{3}{64}$	0.6	9
Nodular, treated Mg, Fe, Si	Bar, 20 by 1 in. ..	$\frac{3}{32}$	1.2	9
Nodular, cast grey pearlitic and then " ferritized"	Not stated	$\frac{1}{32}$ (0.10)	0.8	10
Nodular, cast white and then fully annealed	Not stated	$-\frac{3}{32}$ (−1.10)	−0.8	10
Nodular, inoculated (graphite) as-cast	Not stated	$\frac{1}{32}$ (0.15)	1.3	—
As above, annealed ..	Not stated	$\frac{1}{32}$ (0.10)	0.8	—
Nodular, uninoculated (white) as-cast	Not stated	$\frac{3}{32}$ (0.20)	1.7	—
As above, annealed ..	Not stated	0	0.0	—
Nodular, Ni-Resist, as-cast	Not stated	$\frac{3}{32}$ (0.20)	1.7	—

TABLE III REFERENCES

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(2) *Fonderie Belge*, p. 61 (March, 1952).
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Nicholls and Kershaw[1] pay tribute to the Longden camber graph, but point out that although it describes the camber found necessary for the castings produced at Longden's foundry, the results from similar castings (machine-tool, bed plates, tables, etc.) in their own foundry showed some slight variations which could be explained by the difference in the respective castings. Nevertheless, the graph could be used with confidence once the difference between the types of castings were known, and the authors actually employ the camber graph with modifications for their own castings. The above works emphasize the importance of studying control methods and fully appreciating the nature of the variables, are valuable contributions to the better appreciation of camber allowance.

Heat-treatment Allowances

A further variable may be introduced by subsequent heat-treatment, *i.e.*, growth occurs in the annealing of blackheart malleable iron, and whilst a general figure can be given for most work, this figure is not necessarily a constant and, as in the case of contraction, corrections have to be made for individual castings where a high degree of accuracy is required. Scaling allowances are sometimes made on steel castings and can be as high as $\frac{1}{32}$ in., dependent upon size and the heat-treatment process.

Mould Uniformity

Systems of moulding differ in the method of ramming the sand, and in the type of moulding sand employed, also as to whether the mould is dried or not. Whatever the type of work, however, be it small repetition castings made on high-production moulding machines, or large castings made in pits, consistency in ramming is essential to accuracy, otherwise allowances made for contraction characteristics will mean nothing. This involves a careful study of the ramming methods and moulding sands employed.

Ramming Methods

Moulds rammed mechanically are capable of achieving a higher degree of uniformity and accuracy than hand-rammed moulds (since the latter is dependent upon the individual skill of the moulder), although to achieve the degree of accuracy required with machine methods, a careful study of the machine, patterns and sand practice is necessary. Most moulding machines employed in the foundry are of the squeeze, jolt or jolt/squeeze types. Squeeze machines can be operated pneumatically, hydraulically, electrically or by hand, but jolt machines are usually operated pneumatically. For these the first essential is that an adequate supply of air at a constant pressure be available. Fig. 6 (*a*), (*b*) and (*c*) shows the characteristics of different ramming methods.

Squeeze machines

Squeeze machines are employed for shallow moulding-boxes with a maximum depth of approximately six inches, and for a consistent ram it is essential that a free-flowing sand be used, since an unevenly rammed mould will result unless the resistance to the squeeze is built up uniformly to the joint face. Whilst it is possible with a given synthetic moulding-sand to produce a sound casting over a wide range (perhaps 1 per cent.) of moisture content, such a variation of moisture will, however, produce sands of varying flow characteristics, and for the best results, the sand should be on the dry side of the moisture range. Unless a flat pattern is being employed, allowances have to be made in the design of the squeeze head to overcome variations in rammed density which can occur from a pattern with contours at varying distances from the squeeze head. Compensation for these factors is sometimes made by manually varying the quantity of sand in the box. This can be carried out to a degree by employing a squeeze head following the contours of the pattern.

With vertical coreprints which may come through the cope, the head can be designed with a chamber open at the sides, Fig. 6 (*c*). Holes are drilled connecting with the chamber giving approximately $\frac{1}{8}$-in. clearance on the prints. The pattern prints will then push sand through the holes, which falls out or is squeezed through the side of the head. It is essential that the chamber be of sufficient depth to allow the sand to flow and not pack.

Jolt Machines

The jolt action ensures a tighter packing at the joint, especially with deeper boxes. Prolonged jolting, however, makes the sand very hard at the joint but progressively less dense towards the middle of the box, and it is necessary to finish ramming either manually or preferably by pneumatic hand rammer.

Jolt/Squeeze Machines

These machines combine both the jolt and squeeze actions, in order to overcome the inherent weakness in the ramming action of the squeeze- and jolt-machines. A fault with this type of machine is that frequently insufficient attention is paid to the power of the squeeze stroke, with the result that deeper moulds require to be finished by hand ramming, or by a hammer action against the squeeze head which has an adverse effect upon production speeds and uniformity of ramming. Large-diameter squeeze cylinders or a simultaneous jolt/squeeze should be included allowing maximum penetration. This results in a more uniform rammed density from the top of the mould to the point where the jolt has become less effective in its ramming action.

It is possible when a pattern has steep vertical faces and a flat base to produce a weak corner in the mould, due to sand packing densely upon the flat face as well as the joint, but less densely at the corner adjacent to the flat face. This is often overcome by varying the quantity of sand in the box above the flat face, by using a double squeeze head, or even by manual ramming. These expedients are, however, in many cases, not necessary if thought is given to the choice of machines, size

FIG. 3.—*Differential carrier casting, for which a green-sand core is employed.*

FIG. 4.—*Green-sand-cored brake-drum casting.*

Dimensionally-accurate Castings

of box parts and characteristics of the sand employed.

Boxes should be designed to give a reasonable space between the vertical face and the box side, and in general a tougher and hence less-flowable sand is usually required than on a squeeze machine, due to the more intricate profiles and deeper lifts encountered; again maximum packing is obtained with sand on the dry side of the moisture range.

Impeller Rammers

A notable exception to the machines described is the impeller ramming machine. The density of a sand mould rammed by this machine is controlled by the speed at which sand is thrown into the mould, and the speed of the head as it travels over the pattern. The obtaining of a correctly-rammed mould is, therefore, tied up with the skill of the operator, but a much-higher degree of consistency can be obtained than by hand ramming. The machine is usually employed on medium and heavy work which precludes the economical use of other types of machines. However, with a skilled operator extremely uniform ramming can be obtained and the machine is particularly useful when making work of the smaller type prone to loose packing at corners. It can also be employed in conjunction with stripping machines.

When making larger green-sand moulds it is sometimes necessary to vary the rammed density of certain parts of the mould, as in the case of bed plates made in green sand when a hard corner and sides are required to withstand metal pressure and a softer ram on the plate section is needed to allow for sand expansion in avoiding scabs. This is effected by placing a controlled depth of loose sand on the plate section. One important advantage of impeller ramming, especially when natural sands are employed, is the aeration of the sand resulting in uniform mould surfaces and high permeability for a given mould hardness, enabling harder rammed moulds to be produced without scabbing.

FIG. 5.—*Impeller casting, ¾-in. thick, cast in such a manner as to "leave its own core."*

Moulding Sand

One of the major contributions to improving foundry techniques, production speeds and dimensional accuracy over the past 20 years, has been the increased knowledge of the nature and properties of moulding sands and the control established over these properties. In the past, foundrymen had their own ideas (often influenced by geographical location) of the sand best suited to their particular type of work. Practical techniques were evolved around a given sand and good results obtained at the expense of skill and time. Endless varieties of mixtures, which showed remarkable variation in composition and properties, were used for the same class of work.

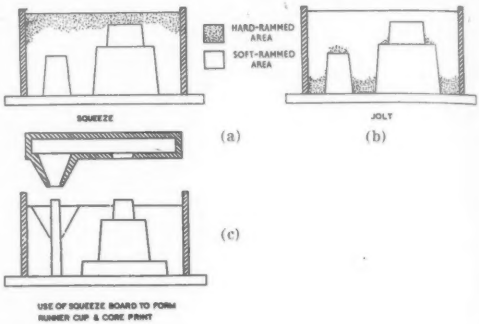

FIG. 6.—*Variation in mould-ramming density with different methods of mould production.*

To some extent this state of affairs still persists, but generally, with the increased knowledge of sands and the introduction of more-efficient sand-preparation plant the number of mixtures have been greatly reduced. In most mechanized foundries it is now the practice to use a unit sand, where all the sand is treated through a central sand plant and no facing is employed, with the result that control is established over the whole of the sand. The smaller works and jobbing foundries have not been able to alter their practice to the same extent as the larger foundries where expensive plant has been installed, but a more intelligent approach to sand control is already being made.

In the past the only sands avilable were of the naturally-bonded type and these sands are still widely used. But with the advent of mass-production methods and improved preparation plant, there has been the development of synthetic sands over the past 20 years. The most important constituents of all foundry sands are silica (quartz) and clay, although with natural sands there are small percentages of more complex minerals which can affect refractoriness. The clay becomes plastic when moisture is added and forms the bond between the sand grains.

It was, however, found that certain very fine clays of a colloidal type had very good water-absorption properties, and when mixed with silica sand in a modern sand-preparation plant formed excellent moulding sands. After drying, this type of sand does not readily renew its strength by a shovelling action and demands a thorough milling to restore its properties. For this reason it is usually confined to mechanized systems of plants using floor methods with provision for periodical re-milling of all the backing sand.

The satisfying of high-speed methods of production, especially for light and medium work, which demand greater dimensional accuracy, whilst exercising machine time to the full, would have been difficult to achieve without the development of the synthetic sands. The primary factors in determining the working properties of a sand are: (1) The shape, size, surface characteristics and distribution of the grains; (2) amount and type of clay; and (3) moisture content, the amount required being somewhat dependent upon the other two.

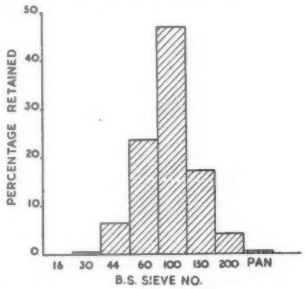

FIG. 7.—*Typical sieve grading of a balanced silica sand.*

Sand grains vary regarding shape and surface condition. Some are well-rounded and worn, others have sharp-angular surfaces and some are sub-angular. The variation of size and shape has an important effect upon the packing of grains, which in turn affects the pore space and permeability as well as the flowability and deformation[9].

The quantity of clay required to bond the grains is a function of the surface of the grain and the voids between them. Angular grains give greater mechanical strength than round grains for the same amount of bonding clay, although round grains give maximum flowability with high permeability, and are of advantage for ease of ramming, especially in core production. However, it is the practice in many mechanized foundries using synthetic sand to rely upon sand from the breakdown of cores to replenish the moulding-sand system; it is then desirable that the same base sand be employed for moulding and core making. It will be appreciated, therefore, that for general foundry purposes a sub-angular type of grain comprising between flowability and strength gives the best results.

Grain Size and Distribution

Most naturally-bonded sands have a fine grain and low permeability and are usually worked between five and seven per cent. moisture. With the synthetic sands, a wider range of grain size and shape is available and a grade or a blending can be chosen, giving optimum properties for any given purpose. They are, therefore, more easily controlled and high permeability can be obtained with low moisture content, moistures usually ranging between three and four per cent.

Grain distribution as well as size and shape has an important effect upon the behaviour of a poured mould and hence upon dimensional accuracy. Uniform grains having the same surface area, expand uniformly and give rise to cracks in the mould and scabs. Sands of varying grain size do not expand uniformly as the small grains are heated more quickly and the mould surface is more rigid. It has been found that the best general results are obtained from a sand showing the majority of grains on three adjacent sieves in the sieve test, with a small percentage on possibly two more adjacent sieves. Such a sand gives high permeability relative to fineness and has a low expansion. Fig. 7 shows a typical grading of this type of sand.

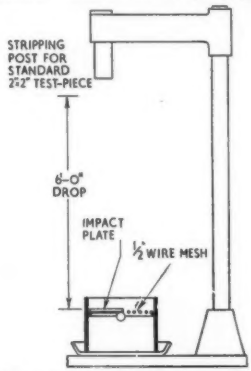

FIG. 8.—*Shatter-test apparatus—a standard AFS sand test-piece is dropped through a height of 6 ft. on to a flat plate, and the shattered sand is then turned over on to a ½-in. sieve, the amount retained on the sieve is expressed as a percentage of the original weight.*

A naturally-bonded sand is usually much less uniform than a synthetic sand. Table IV compares the grading of a synthetic-base sand and a natural sand used for the same type of work.

It will be appreciated, therefore, that a much higher degree of control can be exercised over

TABLE IV.—*Comparison of Grading of Congleton Silica and Natural Sand.*

Sand.	Sieve No.								Clay sub-stance
	16	30	44	60	100	150	200	Pan	
Congleton silica ..	0.0	0.5	6.8	21.7	47.0	17.2	4.3	1.9	0.6
Natural sand ..	0.0	3.5	6.2	15.7	32.6	12.5	Not used	20.3	9.2

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synthetic sand ; also a given mould can be rammed much harder because of the lower moisture content and higher permeability without resorting to artificial venting and other devices necessary to overcome inherent weaknesses in the natural sands. The clays available for use with a synthetic sand vary in their properties, especially as regards the value of the green-, dry- and hot-strength developed, and the moisture required. The relative bonding values of some of these clays are set out in Table V.[10]

TABLE V.—*Relative Bonding Values of Different Clays.*

Type of clay.	Relative bonding power.	
	Green bond.	Dry bond.
Southern bentonite	100	70
Western bentonite	75 to 80	100
Fulbond No. 1	75 to 80	55 to 60
Fulbond No. 2	75	75 to 80
Fireclay	30 to 35	25 to 30

Selection of Properties

Many of these properties are excellent for one type of casting, whilst not being satisfactory for others. If high dry-strength is required western bentonite will give the best results, but for castings such as white iron where the mould is required to collapse quickly, Fulbond is preferred. The physical properties used for routine testing are moisture, green-compression strength, permeability and plasticity. Maximum values for these properties occur

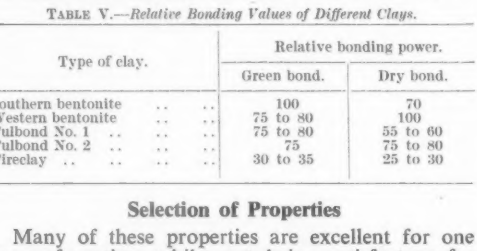

FIG. 9.—*Comparative curves of green-compression strength, permeability and shatter percentage, for a sand of a given clay content but varying moisture content.*

at different moisture contents, and the moisture content chosen is a compromise between a sand condition giving easy working or flow and having sufficient strength to withstand handling of moulds and cores.

Perhaps the most valuable sand test which has been developed, especially when employed for synthetic sands, is the shatter test (Fig. 8) introduced by Sheehan, in which a standard AFS test-piece is dropped through a height of 6 ft. on to a flat plate. The shattered sand is then turned over on to a ½-in. sieve and the amount retained on the sieve is expressed as a percentage of the original weight.

The higher the shatter index, the higher the plasticity of the sand and conversely, the lower the flowability. Suitable shatter percentages for squeeze machines vary between 60 and 68, and for jolt or jolt/squeeze machines, 68 and 75.

With a given sand and a constant clay addition, green-compression strength builds up to a peak with increasing moisture content and gradually falls away. The permeability curve behaves similarly but reaches a peak at a higher moisture content. The shatter percentage increases with increasing moisture content and a moulding sand in its correct shatter range has passed the peak of green compression, but is in the region of optimum permeability. The value of the test is therefore readily obvious; with a well-controlled system sand, it can generally be assumed that if the moisture content and shatter percentage are within the control range, other properties will be satisfactory, and routine testing for green-compression strength and permeability can take place at less frequent intervals. Fig. 9 shows typical relative curves of green-compression strength, permeability, and shatter, plotted against moisture.

Although the importance of the synthetic sands in producing dimensionally-accurate castings has been stressed for some types of work, they have decided disadvantages for others. Without going to a high expense it is not possible to obtain a suitable sand for very small castings where a fine finish is related to dimensional accuracy. They have the disadvantage of drying-out quickly and although they are used for large sand-moulds which require considerable finishing, it is debatable whether they are as satisfactory as the naturally-bonded sands or whether the same degree of dimensional accuracy is obtained. They also have the disadvantage of requiring constant re-milling.

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(To be continued)

A NEW Diesel-electric shunting locomotive has been added to the range of the Yorkshire Engine Company, Limited, a subsidiary of the United Steel Companies, Limited. The new locomotive, which is known as the "Janus," has been developed in conjunction with the British Thomson-Houston Company, Limited, and is being produced in 200 h.p. and 400 h.p. versions. BTH is supplying the transmissions, while the Diesel engines are manufactured by Rolls-Royce, Limited.

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M. John, Brown, Lenox & Company, Limited.
D. Macrae, Babcock & Wilcox, Limited, Renfrew.
F. E. McLoughlin, Head Wrightson & Company, Limited, Stockton-on-Tees.
D. Oxley, Bamfords, Limited, Uttoxeter, Staffs.
E. Skipsey, Armstrong Whitworth (Metal Industries), Limited, Gateshead-on-Tyne.
J. Taylor, Samuel Denison & Sons, Limited, Leeds, 10.
S. B. Woods, National Gas & Oil Engine Company, Limited, Ashton-under-Lyne, Lancs.

Forward Fuel Planning

Firms throughout the country have received from the National Industrial Fuel Efficiency Service an "agenda" on forward fuel planning containing 10 points. It is hoped that boards of directors or proprietors will ensure that these points are incorporated in the actual agendas of the appropriate management or works committees. Regular attention to these points, says NIFES, can bring about savings averaging from 14 per cent. to 17 per cent. of overall fuel consumption.

The first consideration, it is suggested, should be the cost per 1,000 lb. of steam and, second, the real process requirement of steam, compared with actual use and broken down to departments and processes. The third point is the training of boiler firemen. Then there is the question of the fuel bill for winter space heating and peak steam demands. Can the former be reduced by temperature control, insulation, or eliminating heat losses and can the latter be reduced by staggering the load or by thermal storage?

The service goes on to suggest particular study of production bottlenecks leading to heat wastage and the introduction of instrumentation to provide control and records of heat and power input against production. The last three points cover consideration of the use of heat rejected by one process as the heating medium for another, steam linkage with neighbouring works, and the use of the Government loan scheme for purchase of fuel-saving equipment. NIFES concludes by reminding firms that if the answers are not available within their own organizations they should consult the chief engineer of the service.

Working Directors' Remuneration

The Chancellor of the Exchequer's Budget proposal to increase the rate of distributed profits tax is criticized in a statement issued by the Engineering Industries Association, which contends that the further rise aggravates the unfairness of the incidence of this tax on the smaller and medium-sized director-controlled companies. At present, it is stated, the remuneration paid to the working directors of such companies is only allowed as a deduction from profits within certain limits for the purposes of profits tax. While the first of such directors may be paid a total of £2,500 per annum, the remuneration paid to the second, third, and fourth of such working directors in excess of £1,500 per annum each attracts profits tax as if it were a distribution to shareholders, providing that these directors own more than 5 per cent. of the equity capital of the business.

There is a good case, the Association asserts, for an increase in the profits tax limits which were determined at January, 1952, when prices and wages were substantially below to-day's rates. The Association advocates that the allowance of directors' remuneration for profits tax purposes should be increased to not less than £2,500 per annum for each working director, and urges that this be done in this year's Finance Bill.

Research Scholarship in Foundry Work

The Council of Ironfoundry Association's training and education committee has recently considered the establishment of a research scholarship in foundry work at Birmingham University. The committee's attention was drawn to the fact that frequently graduates in the foundry group of the University's department of industrial metallurgy, who wish to continue work at the University for their Ph.D. degree, are obliged to seek scholarships endowed by other industries, and are thus lost to the foundry industry. Alternatively, it is believed that many are lost to the industry after graduating and doing their National Service, because they have not become sufficiently specialized to ensure their return to foundry work.

On the recommendation of the training committee and with the support of the Joint Iron Council finance committee, the Council has informed the University authorities of the intention to establish, in the autumn of 1956, a research scholarship in a branch of foundry work in the department of industrial metallurgy. The J.I.C. has agreed to make a grant of £300 per annum for four years to enable this to be done.

Record Machine-tool Orders

Activity in Britain's machine-tool industry fell slightly in January and, with new orders exceeding deliveries, the total order-book rose to a record level at the end of the month. Home and export deliveries during the month totalled £6,398.000. This was about £150,000 more than the monthly average for 1955, but over £300.000 less than the monthly aver-

Orders valued at £8,196,000 were received during the month. This was slightly above the high rate shown between October and December last year. Both home orders of £6,322,000 and export orders of £1,874,000 were little changed from the average of the three preceding months.

As the result of an undiminished flow of new orders and a decline in the rate of output the industry's total order-book at the end of January rose to £101,421,000, of which £79.155.000 was outstanding for home buyers and £22.266,000 for export markets. age for the last quarter of that year.

W. R. Ironfounders Discuss Health Provisions

Authoritative Lead on the New Regulations

Mr. T. W. McCullough, H.M. Deputy Chief Inspector of Factories, addressed a meeting organized by the West Riding Ironfounders' Association at the Midland Hotel, Bradford, Yorkshire, at the end of last year. The meeting, which attracted 168 ironfoundry executives was called in order that Mr. McCullough could discuss the provisions of the Iron and Steel Foundries Regulations 1953.

Change of Opinion

After reviewing the history of the Regulations, Mr. McCullough went into detailed analysis of present-day problems, one of the most vexing of which, he said, was ventilation at the knock-out and during fettling. Referring to knock-outs, he said it was originally thought that the methods to be adopted, in order of preference, were as follow:

1. Complete enclosure of a central knock-out station—generally only possible in the case of mechanized foundries.
2. Upward exhaust—because this method took advantage of the upward thermal currents.
3. Side exhaust.
4. Downward exhaust—placed last because of the difficulties associated with turning the thermal currents through 180 deg. to take them through the floors.

The experts had, however, now changed their minds. They had nothing to add to their views that complete enclosure was the ideal solution if it were possible, but were not so happy as previously about upward exhaust because, generally speaking, there were so many cross currents in a foundry that the air did not rise vertically. Consequently, in many cases where upward exhaust might be applied, it would be necessary for the men engaged on knocking-out the moulds to get their heads in a direct line between the origin of the fumes and the method of taking them away, with the result that their heads and shoulders would be exposed to the dust and fumes which it was desirable to avoid. Mr. McCullough qualified the matter, however, by saying that wherever it was possible—in the larger mechanized-type foundry—to get the moulding boxes under exhaust ventilation without the presence of a man, that was by doing it mechanically, then there was nothing wrong with upward exhaust. Currently, the latest idea was to have side exhaust directed slightly upwards in a booth, and that was working very well in quite a number of places. In fact, at the recent steelfounders conference on ventilation at York, several photographs of this type of plant were shown to be working in a most satisfactory manner. So nowadays, he would like founders to think not so much of upward exhaust but side exhaust inclined slightly upwards and working in a booth. He was led to understand that the manufacturers also were working along these lines.

Respiration

On the subject of Regulation 8 (protective equipment), Mr. McCullough had an interesting suggestion. He made a plea for more respirator cleaning stations, because a respirator was an awkward thing to wear. It was the last line of defence in places where it was essential to wear respirators—a case either of wearing them or risking silicosis or pneumoconiosis at the very least. Using them must, therefore, be made as attractive as possible to the wearer. Many firms to-day had provided their men each with two respirators, one to wear and one as it were " at the wash "—at the respirator cleaning station which quite a number of large firms already possessed. A respirator sent for service was dismantled, disinfected, serviced, generally cleaned up and put back in a man's box ready for him to collect.

He suggested that, where there were a number of foundries in the same area and it was felt there were insufficient facilities to carry out this cleaning business, that they banded together and set up a small respirator cleaning station. A girl could be trained to do the work very quickly and very efficiently and the founders would then be in a position to encourage workpeople to use their respirators. If a respirator was not clean the only place a man would wear it, if at all, was on his chest!

Goggles

Still on the subject of Regulation 8, Mr. McCullough spoke on the provision of suitable goggles and other eye protection for people working at the spout of, or attending to, a cupola or furnace, where there was risk to the eyes from molten metal. It might not be generally known, he said, that the Chief Inspector had just set up a joint advisory committee, to discover the best types of eye protection, goggles or otherwise, to be worn by men engaged in arduous physical effort in the presence of molten metal. On this committee there was the usual representation of both sides of the industry, some experts from the Factory Department, and others.

The difficulties associated with steaming were well known, as also were the troubles associated with Perspex as opposed to glass, what colour the glass should be, and so on. It was to be hoped that in a reasonable space of time the committee would have something useful to tell not only the iron branch of the foundry industry but also the non-ferrous and the steel sections as well, because all three interests were represented on this new body.

It was noted that in Regulation 8, every person employed was to make full and proper use of the equipment provided for his protection and he shall (shall meant must) without delay report to the employer, manager or other appropriate person, any difficulty, defect in, or loss of the same.

W. R. Ironfounders Discuss Health Provisions

Bathing Facilities

Dealing with bathing facilities and clothing accommodation, Mr. McCullough said it was undoubtedly in this field that the greatest progress was made voluntarily, long before the impact of the Regulations, by the larger firms and by some of the smaller ones as well. Many people, although they had had two years' warning about the requirements, had done nothing at all, and they were now hoping they would get exemption. Exemption, however, was not going to be easy, and Chief Inspector's certificates were not going to be used as a means of perpetuating bad conditions.

The provision of bathing facilities represented a forward movement and foundry owners would have to face it; many had done so already. Some of the arguments which had been advanced as to why a firm should not have baths were fatuous in the extreme. Some employers asked "Why should they have to provide baths when the engineers were not compelled to do so?" The Regulations said that there should be baths for foundry workers—there were no regulations which said that there would be baths for engineers.

Every case for postponement was very carefully examined on its merits after full reports and after the Department had heard the views of the workpeople. He could assure iron founders that the Chief Inspector was prepared to consider exemptions only where structural facilities simply did not exist or where cost might be a very large factor, *vis-à-vis* the size of the undertaking. He hoped his audience was all fair-minded enough to admit that it would be most unjust for some people to get exemptions while others had tried to set their houses in order by providing baths. Likewise, he sympathized with any firm who had gone to the trouble to put in baths and was dissatisfied because the "fellow round the corner" had got an exemption.

The industry had got to educate workpeople in using the facilities provided. In certain parts of the country, as far back as 1948-9, baths were being installed, admittedly by the larger firms, and there was the old story from the men. "We don't want them, don't put them in." To-day those baths were fully used, and in a number of cases they had been extended. His advice was, when installing baths, to put them in as generously as finance would allow, because the better the quality of the installation, the more inviting and attractive it would be to the men and less was the likelihood of abuse.

He reassured his audience that the unions, at the time of the signing of the Garrett Report—when this matter first came to the fore—said that they would make it a matter of union discipline if any case of abuse were reported to them arising from members. That was something which he asked founders to bear in mind. From experience, he knew that where baths had been installed, they had been greatly appreciated. He did not see why a man should not have the elementary privilege of leaving his dirt in the place in which he acquired it. Why should he have to go home a social pariah in public transport, a nuisance to his fellow passengers and, when he arrived home, a bigger nuisance to his wife?

Taking the long view, if founders did not provide the conditions which these Regulations called for, they would not be able to attract young people to the industry.

Question Time

The meeting was thrown open for questions, and in answer to one asking whether there was any relationship between the number of baths and showers to the number of employees, Mr. McCullough said the ultimate figure was really a matter between the employer and his workpeople—a standard of something like 1 in 10 was the kind of thing to aim at, but there was no specific law about it beyond adequacy and suitability. When considering shower-baths, one tip he gave was that managements should bring their employees into their discussions, for in so doing many of their problems and troubles would sort themselves out.

In conclusion, Mr. McCullough said there was still a very long way to go—but much progress had been made. In fact, more progress had been made towards safety, health and welfare in the iron foundries of this country in the past ten years than had been made in the previous 100. This was no reason, however, to rest upon the laurels won. Rather let it be said that the results of the past would give encouragement to tackle the problems of the future.

Basic Materials Prices in 1955

The Board of Trade's two indices employed for showing fluctuations in the prices of materials used in the mechanical and electrical engineering industries recorded an average rise of more than 13 per cent. last year. This brought them to a level well above that reached at any time during or since the Korean war. There was an increase of slightly over 6 per cent. in the index for basic materials, but these prices showed no signs of rising to the levels reached in 1951.

However, the *Board of Trade Journal* shows that despite these rises in the cost of materials and fuel and the advance of about 7 per cent. in wage rates, the wholesale price index for all manufactured products rose by only 4.9 per cent. during 1955.

Change of Name

For purely administrative reasons, the Glanmor Foundry Company, Limited, which is owned by Glanmorfa, Limited, is being put into a members voluntary liquidation, and the operation of the Glanmor Foundry will henceforward be in the name of the parent company (Glanmorfa, Limited). In effect, the liquidation will involve a change in name only, production at the Glanmor Foundry will continue as before and involve the same staff and employees. It is understood that the liquidation of the company, which now merges its identity with that of Glanmorfa, Limited, was contemplated before the war upon the formation of Glanmorfa, Limited, as the parent company. The process was, however, postponed by the advent of war and subsequently other delaying circumstances arose.

Book Reviews

Proceedings of the 1955 Convention. Published by the Institute of British Foundrymen—Australian branch (Victoria).

This paper-backed book runs to 122 pages covering half-a-dozen papers, two of which are from this country. One is an excellent contribution to the subject of "Dimensionally-accurate Castings,"* by Mr. John Hill, of Ley's Malleable Castings Company, Limited, and the second on the "Mechanism of Blister Formation in Cast-iron Enamels," by E. R. Evans, of the British Cast Iron Research Association. Two of the other papers included are of the "exchange" variety. One, from the New South Wales division of the Institute of Australian Foundrymen, is by Mr. Hedley Thomas, on "Foundry Quality Control," and the second, from the American Foundrymen's Society, is entitled "New Horizons in Foundry Progress," by Mr. Hans J. Heine. An interesting figure which appears in this paper is that about 3,570 tons of shell-moulding resins were sold in the United States in 1954. A paper of great local interest is that by Mr. A. M. Waterwoth, A.M.T.C., and deals with Marchagee bentonite as a bonding agent. The author is foundry-sands investigator of the Commonwealth Scientific and Industrial Research Organization. He concludes that Marchagee clay is similar in behaviour to a southern-type American bentonite (from the northern-Mississippi area). A very good illustrated description of the foundry of M. B. John, Limited, Ballarat, is given by two of its staff, Mr. B. S. Barham and Mr. H. J. Hassell. This 60-year-old concern is stated to be the largest firm of valve manufacturers in the southern hemisphere. Since 1951, it has been rehoused on a new site in Ballarat, the foundry section dating from 1948. Using 20,000 patterns, the plant turns out weekly 16 to 20 tons of non-ferrous castings, but has a potential output of 50 tons. It is a modern foundry in every sense of the word, the control systems in vogue include X-ray examination, whilst the amenities available to the workpeople are comparable with the best in this country. Altogether, this report of IBF activities "down under" makes a very interesting publication.

* See p. 293 of this issue

Steam Boiler Year-book and Manual, V. Edited by R. J. Millson and published by Elek Books Limited, 14, Great James Street, London, W.C.1; price 42s. net.

The fifth volume of this reference book is a great improvement on its predecessors and presents a surprisingly up-to-date survey of steam-raising practice over a very wide field. Coal-, oil- and gas-firing are dealt with adequately, and it is a pleasure to see the prominence given to the modern chain-grate stoker suitable for shell boilers—the most recent field for the travelling-grate plant. More might have been written on oil-burners using high oil-pressures, *i.e.* above 200 lb. per sq. in., such as are dictated by the increasing use of residual oils for large, individual-burner outputs.

The section on automatic boiler-control will be useful to many industrial plant engineers, as automatic control of steam-raising equipment offers economies in fuel and manpower in many plants, particularly those with cyclic operational features. There is a very useful and concise section on special water-tube boilers which has the virtue of presenting the main features of the more-rare boilers, knowledge of which is essential for the serious student of steam generation. Included in the more normal water-tube-generator section is the Lewis boiler which, as the modern version of the Niclausse boiler, has perhaps not received the attention it deserves. The Perkins tube is dealt with, but unfortunately the sketch of the tube, Fig. 11/23, has been printed upside down—a slight flaw in a book which seems to have been put together with more thought than is customary in such matters these days. A useful bibliography for those who wish to follow up any particular feature winds up a publication of great value to the plant engineer and the student of steam generation.

T.S.

Properties of Aluminium and its Alloys; published as *Bulletin* No. 2 by the Aluminium Development Association, 33, Grosvenor Street, London, W.1.; price 7s. 1d.

Since 1944, there have been several editions of this valuable publication, necessitated by revisions of specifications and general progress. This is emphasized by the inclusion with the book of two pamphlets—"Revision of British Standards for Aluminium Magnesium/Silicon Heat-treatable Wrought Alloys," and "Revised British Standard for Aluminium—alloy Ingots and Castings for General Engineering Purposes." These leaflets describe certain changes effected in the 1955 revision of the Standards, but do not repeat the data given in the Standards themselves.

The book, which runs to just over 200 pages, can be regarded as a reliable work of reference on the subject. The casting section is fully dealt with in Tables VII to IX, which detail all the B.S. Specifications for general engineering and aircraft castings and the D.T.D. Specifications for the latter. Added value is given by the inclusion of trade names identifiable with the various specifications.

A very handy section of this book is the one detailing the composition of North American and European proprietary alloys. It is a very valuable publication and its usefulness is increased by being thoroughly revised.

Creep and Fracture of Metals at High Temperature. Issued by the National Physical Laboratory and published by Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2.; price 31s. 5d., post free.

This report covers a three-day symposium, which was attended by many leading scientists from 15 countries, including Australia, France, Germany, Great Britain, Japan, USA, and the USSR. The papers and discussions reflected the growing interest in the development and use of creep-resisting alloys, recorded the advances made in understanding the mechanism of creep processes, and drew attention to the implications of these phenomena.

All 22 papers and the summarized discussions upon them are included in the volume. They are presented in four sections, covering, respectively, deformation in simple material, creep resistance in complex materials, the theory of fracture, and work on tertiary creep and fracture.

Gussfehler—Atlas, Vol. 1 (in German); published by Giesserei-Verlag G.m.b.H., 27 Breite Strasse, Düsseldorf; price 26.0 D.M.

This is an authorized translation of the *Album de Defauts de Fonderie*, which the French foundry association published on behalf of the International Committee of Foundry Technical Associations. The translation no doubt is of a high order whilst the general production of the book is excellent.

Equipment and Supplies

Factory Vacuum Cleaner

Bivac Air Company, Limited, Black Lane Engineering Works, Radcliffe, Manchester, have designed a factory floor-sweeper as a contribution to the implementation of the new Foundry Regulations. Through its use, floor cleaning takes place by using a wide, cast floor nozzle with an extension tube coupled to either end of the cleaner. Floor-cleaning on a rapid scale demands efficient filtration to separate dust and air and the Clear-Flo system has been adopted and duplicate filter units applied. Aspirated dust and air is drawn into two collectors and subjected to cyclonic action to deposit the heavier particles direct into the dust bins which are of such a capacity as to enable a man to lift them when full. The cleaner is self-contained, self-propelled and the filters are self-cleaning. A substantial steel channel frame is mounted on the four pneumatic-tyred wheels with automobile tyres 17 by 4.75 in. Akermann type steering is provided, control being through an extended handle with a sensitive, hand-controlled, cable-operated clutch, moving the complete unit at two miles per hour. Obstructions on the floor, such as bricks, railway crossings and small casting headers are easily surmounted. A " push-pull " brake is fitted for parking. The motive power for driving the suction producer and the machine is from an air-cooled 10-h.p. diesel-engine, and a vee-rope drive transmits the power from the engine to the exhauster which is of standard Bivac, multi-stage, turbo type. For picking up foundry sand, adequate air displacement has been provided. Care has been taken in guarding moving parts and to keep maintenance low. The overall size is approximately 6-ft. 6-in. long by 6-ft. 6-in. high by 4-ft. 6-in. wide, and the cleaner weighs about 10 cwt.

Pre-coating Resins

Catalin Industrial Resins, Limited, Waltham Abbey, Essex, have developed a new resin for the pre-coating of hot sand for shell moulds and cores—Catacote 243P. It is claimed to be particularly rapid-curing and at the same time has a good flow, so that it gives excellent build during investment and a quick cure in the oven, resulting in a biscuit which can be readily ejected from the patternplate without distortion. According to the quality of sand employed and required shell strength, it is recommended that from 3 to 6 parts by weight of the resin per 100 parts by weight of sand is used. It is stated that no high degree of skill is required in formulating suitable pre-coated sands when using this grade of resin.

For those foundries where hot sand is not readily available, an additional resin—Catacote 250P—has been developed which can be applied to cold or warm sand. The resin is inherently thermosetting and can be easily handled on existing sand mixers of the open type. The following hints are given in connection with the adoption of this material: Investment times are claimed to be 20 per cent. shorter—with pattern temperatures in the region of 200 to 250 deg. C.—than with powder mixtures; it is particularly suitable for use with automatic shell-moulding machines, because of the rapidity of curing—30 seconds at an oven temperature of 400 deg. C. is quoted as ample. The low-resin content, with tightness of cure of the pre-coated sand, ensures that fuming during pouring is considerably reduced and sand can be easily reclaimed.

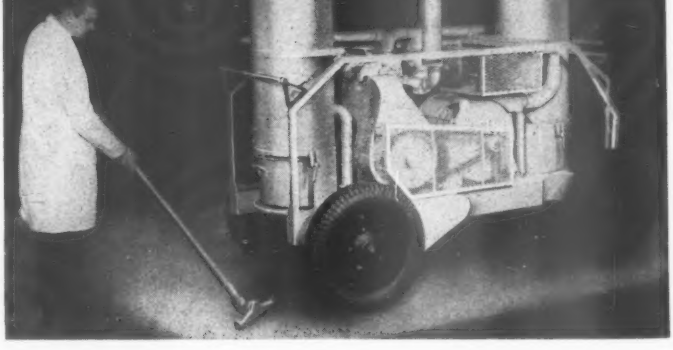


FIG. 1. — *Bivac heavy-duty vacuum cleaner, suitable for foundry floors and gangways.*

Spray-booth Ventilation

A new type of paint spray-booth of American pattern has been installed in the cab-assembly factory of Leyland Motors, Limited. Although comparatively small—the floor area is only 15 ft. square—the booth has approximately 30,000 cub. ft. of air passing through it each minute to maintain a paint-free atmosphere for the operators. Unlike other booths which have previously been put in use in this section of the works, the new booth is a down-draught tunnel-type, with a concealed water-section. Incoming air is piped to the booth from outside the factory; it passes through grid filters and is heated by a gas-fired heater which is thermostatically controlled. The heated air enters the booth through grilles in the roof and is extracted through gratings in the floor to a washing plant, and through cavities in the walls of the booth to the outside atmosphere. Below the gratings in the floor are water-filled tanks of 600 cub. ft. capacity. This water is re-circulated by two pumps at a rate of 800 gall. per min. The booth, which has been built locally by Thermic Equipment and Engineering Company, Limited, of Preston, will be used for prime painting drivers' cabs for Leyland goods vehicles, and the cab sub-structure for passenger vehicles.

Rotary Extractor

An entirely new self-cleaning rotary-type magnetic extractor has been introduced by Rapid Magnetic Machines, Lombard Street, Birmingham. Basically the unit takes the form of a magnetic cylinder incorporating a diverting scroll. The equipment is arranged to rotate above, or at the point where tramp iron, turnings, chippings, etc., are to be collected. Rotation of the drum gives progressive movement of the collected iron, and according to need, can be discharged to either or each side. Its application in foundries is wide and various, covering such fields as conveyor systems, or wherever iron or steel is to be extracted and automatically discharged.

British Non-ferrous Metals Research Association

"*Foundry*" *Aspects of the Year's Activity*

The following extracts of major interest to founders have been culled from the annual report of the British Non-ferrous Metals Research Association, published last week:—

During the year there has been a net increase of nine in the membership, bringing the total to 617.

On the occasion of the completion of 25 years' occupation of the Euston Street laboratories in London, the Association was honoured by a visit from HRH The Duke of Edinburgh, who spent the afternoon of May 23 in the laboratories. His Royal Highness toured the whole premises, examining in detail the work in progress and the exhibits arranged for the Open Week which followed. The keen interest which he showed in all the work was of great encouragement to the Association and particularly to the staff.

During the remainder of that week the laboratories were open to inspection by representatives of members, and by a number of invited guests. In all, nearly 700 visitors toured the laboratories and the interest shown amply recompensed the staff for their strenuous work in its organization. At the same time, the occasion was taken to prepare a brochure describing the growth of the Association and some of its main achievements during the 25 years in which it has possessed laboratories near Euston. Some 2,000 copies of this brochure were prepared and have been distributed to members and others interested.

Income

The 1955 income was very close to that of the previous year. Members' subscriptions and government grant totalled £118,600 which, in spite of the increase in membership, was only £600 more than in 1954 since £750 of grant-earning income in that year was non-recurring. Government fees were £1,000 higher in 1954. The total of £142,000 was, therefore, £2,000 above that of the previous year.

Expenditure

Expenditure was up by £8,000 leaving an excess of income over expenditure for 1955 of £2,000 compared with £8,000 in the previous year. The higher expenditure was due mainly to increases in salaries and wages of about £5,000, in materials and consumable stores of £2,000 (although this increase has been more than offset by the sale of an abnormally large amount of scrap realizing £3,000), and the expenditure of £2,000 on repairs to property.

The continuing rise in salaries and wages makes a major contribution to the steadily increasing cost of the Association's operations. As the Association's experience during 1955 has shown, the recruitment and retention of suitable staff is possible only if salaries and wages in the Association are kept in line with those in industry and other competing employments. Although between 1949 and 1955 the staff, principally in the scientific grade, was reduced in total numbers from 162 to 153, the salary and wages bill increased by 38 per cent. from £62,600 to £86,600. This represents an increase of 45 per cent. in the average remuneration of each member of staff, which does not seem unduly high in comparison with the official figure of 50 per cent. increase in industrial salaries and wages between 1949 and 1954 (the last year for which figures are available). While thus recognizing the inescapable growth of expenditure under prevailing conditions, the Association does not have at its disposal any easy method of securing that increase in income necessary even to maintain its existing scale of operations.

Future of the Association

Further consideration has been given during the year to the implementation of the recommendations of the committee on the future of the association, whose report was adopted at the end of last year. The Council is now planning the financing of the Association so as to give an income in 1957 and the subsequent four years, which will permit the intended programme to be carried out without further appeals for increases during that term.

Laboratory Accommodation

During the early part of the year the first floor of No. 22 Euston Buildings was fully utilized for the Association's work. An extension of the general metallurgy laboratory in the north end of this floor now houses the titanium-melting equipment and other bulky apparatus of this section. Extensive and somewhat costly repairs have been necessary during the year to this part of the property which, at the time of writing, is being re-roofed and treated for the eradication of dry rot.

As a part of the consideration of the Association's future referred to above, plans are being drawn up for building a new laboratory extending the main building in Euston Street to cover the 90 by 45 ft. site of six houses—Nos. 93 to 103 (three of which—93 to 97—were demolished some time ago). Planning permission has been secured in principle and careful consideration is being given to the best utilization of this proposed additional freehold block.

Staff

The number of resignations from the staff, particularly the scientific staff, during 1955 threatened at one stage to have a crippling effect on the Association's work. Fourteen of the investigator and research assistant grades left for other positions—nearly all in industry—during the year, and three more resignations were received towards the end of the year to take effect early in 1956 (totalling over 30 per cent. of the scientific staff). Council gave urgent and detailed consideration to this situation and made suggestions on the conditions of employment in the Association which have greatly improved the recruiting rate, and although only seven investigator grade staff were engaged in 1955, another six investigator or research assistant grades had accepted appointments before the end of the

British Non-ferrous Metals Research Association

year and joined the staff early in 1956.

Among those who have left are Dr. G. L. J. Bailey, the deputy research manager; Dr. P. T. Gilbert, head of the corrosion section; and Mr. E. A. Ollard, our electrodeposition adviser. The loss of senior and experienced men such as these is bound to constitute a severe set-back. Dr. Bailey's departure in particular is a serious loss to both the scientific work and administration of the research department. It is not proposed in the immediate future to make a fresh appointment of deputy research manager but to try and ease the burden of the research manager by devolving some of the duties, formerly carried out by Dr. Baker and Dr. Bailey, on to the section heads. Dr. Bailey was also responsible for the work of the physics section, and it is fortunate that early in the New Year the services were secured of Mr. F. R. Bareham as head of this section.

The vacancy of head of the corrosion section, caused by the resignation of Dr. Gilbert, has been filled by the promotion of Mr. H. S. Campbell, and the Association has been fortunate in securing the services of Dr. D. van Rooyen as a senior investigator to support Mr. Campbell in that section. Mr. Ollard, whose liaison work in the electroplating industry is so well known, is succeeded by Mr. S. W. Baier. While, therefore, the staff situation during the year caused the greatest anxiety, fortunately the position at the start of 1956 was more satisfactory than had at one time seemed possible. During the year presentations were made by the chairman, in the presence of Council, to five more members of staff on completion of 25 years' service with the Association:—Miss T. M. Harris; Mr. R. May; Mr. B. Fullman; Dr. J. McKeown; Mr. G. L. Bailey.

REVIEW OF RESEARCH PROGRESS

The research programme carried out during the year has departed little from that laid down by the Research Board in December, 1954. Owing to the limitation on the funds, selection had to be made as authorized by the Board between a number of projects which could not all be carried on together, with the inevitable result that the programme has been somewhat overcrowded and the temptation to diffuse the available resources over too wide a field has again been difficult to resist. The considerable number of staff changes, already referred to, has also introduced a complication in the efficient execution of the programme, but the review of progress shows the considerable amount of work that has been successfully carried through during the year.

In what followed in the Report the researches are not discussed individually, but in groups on similar or related subjects, and from these the following has been abstracted:—

Copper, Nickel and Their Alloys

Laboratory work on refractory materials for lining low-frequency induction furnaces seems to be following a promising line, and there are hopes that some of the refractories examined may be useful for melting cupro-nickels, for which at present no really satisfactory lining is available. Among other things, attention has been given to the problem of firing a refractory *in situ* to a high temperature, and the trials so far carried out in members' works are encouraging.

Changes in staff have hindered progress of the study of the solubility of copper in refractory smelting slags, but the analytical problems encountered in this work are now satisfactorily solved—notably the determination of ferrous and ferric iron in slags in the presence of sulphides. A little further investigation on the electrolytic purification of molten copper using a fused salt bath electrolyte, has revealed such serious practical difficulties when the process is attempted on a somewhat larger scale that no further work is anticipated. The laboratory study of the removal of traces of lead and of tin from copper has been completed, and the improved methods developed for the removal of lead are now in regular industrial use.

An earlier review of the extensive literature on the gating of castings, pointed to a number of gating systems which should materially improve the cleanliness of castings in alloys prone to form dross during pouring, and experimental work has confirmed the claims made for these systems and has shown that in some cases they may be modified to simplify moulding practice without detriment to the cleanliness of the casting.

In the course of a survey of the shell-moulding process carried out in connection with an Advisory Service for the bronze foundry industry operated by the Association with the assistance of monies from Conditional Aid Funds, a number of points were revealed where existing information was conflicting or uncertain. Most of these points related to the efficient use of the resin bonding material—which is a major factor in the economics of the process—and experimental work has been done to resolve obscure points.

Creep Properties of Gunmetals

The programme now completed has shown that of the several alloys tested, the one generally expected to be least resistant to creep at the highest temperature in the range considered is, in fact, the most resistant. It is expected that the findings of this work will resolve certain difficulties encountered in revision of relevant standards.

Aluminium, Magnesium and Their Alloys

A study of the relation between composition and casting conditions and the form and distribution of intermetallics in certain high-strength aluminium alloys has been taken to an interim stage, but has been curtailed because other items in the programme require higher priority.

Liaison Department

Technical Enquiries

In the past ten years, the liaison department has dealt with almost 10,000 technical enquiries. In 1954, the number of enquiries received reached the

record of 1,297, but this year there has been a slight fall, the total received being 1,163. This means that between four and five problems are received by the department each working day. These are problems requiring either a practical investigation or a visit to the site or a considered opinion about some technical point and, for the most part, they are not the sort of problems that can be answered directly from recorded data such as are generally handled by the information department. The various specialists in the research department are freely consulted about the enquiries received and a considerable amount of service work such as analyses, metallographic preparations and mechanical testing is carried out by different sections of the research department.

No fewer than 48 per cent. of the membership of the Association took advantage of this service in 1955, and a considerable number of enquiries were also received from Government departments, other research associations and various public bodies.

Liaison Work

The liaison staff made over 300 visits to members during the year, many in connection with specific technical problems, but almost all visits provide an opportunity for a wider discussion about work in progress in the laboratories. The liaison department received about 220 visits from the staff of member firms either to see work in progress in the research laboratories or for discussions of specific problems. Altogether in these ways personal contacts were made with about one-third of the membership during the year.

Conditional Aid

Reference was made in the last annual report to an agreement with the Association of Bronze and Brass Founders for a member of the liaison staff to act as shell-moulding adviser in connection with the ABBF'S Conditional Aid Advisory Service. A detailed study of shell-moulding plant and practice was made as a preliminary to this advisory work, and a report issued, surveying the field, has been extremely well received, over 800 copies having been distributed either by the Association direct or through the ABBF. So successful was this work that the ABBF asked for a similar survey to be made of the application of the CO_2 Process for bonding sand for making cores and moulds, and this has almost been completed.*

* Published after the Annual Report has been compiled—Editor.

BUTTERLEY COMPANY, LIMITED, Ripley, Derbyshire, have received an order for 300 20-ton wagons for British Railways, worth £250,000.

THE MINISTER OF LABOUR AND NATIONAL SERVICE has announced the decision to revoke the Notification of Vacancies Orders, 1952, with effect from May 7 inclusive. These Orders, which place a restriction on the engagement of workers by employers, were devised to provide Employment Exchanges with a special opportunity of trying to persuade workers to accept one job that was of particular national importance, rather than another that was of less importance. The Orders apply to men aged 18-65 and women aged 18-60 with certain exceptions.

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

744,599. Armo International Corporation, 793, Curtis Street, Middletown, Ohio, USA.

Internal-combustion-engine valves and valve parts of stainless steel. They are claimed to have great hardness at high temperatures and substantial resistance to corrosion in the presence of leaded-fuel combustion products. The formula for this steel would be: carbon 0.08 to 1.5, chromium 12 to 30, nickel 2 to 35, manganese 3 to 12 and nitrogen 0.06 to 0.60 per cent., in proportions to ensure a substantially austenitic structure, plus silicon not exceeding 0.45 per cent., the remainder being iron.

744,600. Timken Roller Bearing Company, Canton, Ohio, USA.

A method of heat-treating a steel containing carbon 0.18 to 0.28, chromium 1 to 2, manganese 0.3 to 0.6, molybdenum 0.4 to 0.6, silicon 0.5 to 1 and vanadium 0.7 to 0.9 per cent., the remainder being iron apart from usual impurities. The steel is quenched from at least 955 deg. C. by an air quench, and tempered to 300 to 350 Brinell, whereby the steel has a tempered martensitic structure and a 1,000 hr. rupture strength at 593 deg. C. in excess of 13.4 tons per sq. in.

744,626. Société D'Electro-Chimie, D'Electro-Metallurgie et des Acieries Electriques d'Ugine, 10 Rue du General Foy, Paris, Seine, France.

A process for the recovery of manganese from basic-open-hearth slags. The slag is first converted into an acid slag by adding silica or titania in a proportion of 300 to 600 kg. of silica or of 400 to 800 kg. of titania per ton of slag. The acid slag thus obtained is then partially reduced to obtain a major proportion of the phosphorus and sulphur therefrom. Substantially, the manganese is retained in the slag so that the slag is refined and rendered suitable for any subsequent process for which it is desired to use it as a source of manganese. The treated slag can be further reduced to recover manganese as ferro-manganese.

744,720. VEB Fachanstalt Fur Giesserei-Wesen, 19 Tharandter Landstrasse, Dresden-Dolzschen, Germany.

A heat-evolving mouldable and hardenable chemical composition. It is composed of a heat-evolving mixture comprising at least 16 per cent. aluminium, other combustibles such as coke breeze, one or more oxidizing agents, and an ignition agent for initiating the reaction between the aluminium and the other constituents. This can comprise magnesium or magnesium-containing alloy or alloys, containing at least 90 per cent. magnesium and a nitrate, preferably an alkali-metal nitrate. The amount of the oxidizing agent or agents is sufficient to effect complete combustion of the aluminium and other combustible agents. The purpose of the composition is to heat up the molten metal in risers and sprues or gates of a mould during casting and to maintain it in a fluid condition. It is claimed to effect economies, particularly in steel foundries.

THE FOUNDRY beat the staff 4—2 in the final of the inter-departmental football competition at Hadfields, Limited, steelmakers, Sheffield, on Thursday, May 3. The Nicholson Cup was presented to the winning team by Mr. F. A. Bailey, local director and engineering controller. The game was played on the works sports ground at Bawtry Road, Sheffield.

British Blast Furnaces in the March Quarter, 1956

(These tables are published through the courtesy of the British Iron and Steel Federation.)

Derbyshire, Leicestershire, Notts, Northants, and Essex.

Name of firm.	In blast at end of the first quarter, 1956.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Clay Cross Co. (Iron & Foundries)	—	—	1	—	1	1	2
Ford Motor	—	—	1	—	1	1	1
Holwell Iron	—	1	2	—	3	3	4
Kettering Iron & Coal	—	—	1	—	1	1	2
New Cransley Iron & Steel	—	—	1	—	1	1	2
Renishaw Iron	—	—	2	—	2	2	2
Sheepbridge	—	1	1	—	2	2	2
Stanton Ironworks: Stanton-by-Dale	—	—	4	—	4	4.7	5
Staveley Iron & Chemical	—	—	4	—	4	4	4
Stewarts and Lloyds: Corby	—	4	—	—	4	4	4
Wellingboro' Iron	—	2	—	—	2	2	3
TOTAL	—	8	17	—	25	25.7	31

Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.

Brymbo Steel	—	1	—	—	1	1	1
Darwen & Mostyn	—	—	—	1	1	1	2
Lancashire Steel Corp'n.	—	2	—	1	3	3	3
Summers, J.	—	2	—	—	2	2	2
TOTAL	—	5	—	2	7	7	8

North-West Coast.

Barrow Ironworks	3	—	—	—	3	3	4
Charcoal Iron	—	—	1	—	1	1	1
Millom & Askam	2	—	—	—	2	2	2
United Steel: Workington	2	—	—	1	3	3	3
TOTAL	7	—	1	1	9	9	10

Lincolnshire.

Appleby-Frodingham	—	4	—	—	4	4	4
Lysaght's Scunthorpe Works	—	4	—	—	3	3.1	4
Thomas, R., & Baldwins: Redbourn	—	3	—	—	3	3	3
TOTAL	—	10	—	—	10	10.1	11

North-East Coast.

Consett Iron	—	3	—	—	3	3	3
Dorman Long (Steel): Acklam	—	2	—	—	2	2	4
Redcar	—	2	—	—	2	2	2
Cleveland	—	2	—	—	2	2	4
Bessemer	—	2	—	1	3	3	3
South Bank	—	—	—	—	—	—	3
Gjers, Mills & Co.	2	—	—	—	2	2	5
Normanby Ironworks	2	—	—	—	2	2	3
Skinningrove Iron	—	1	—	—	1	1	3
South Durham Steel & Iron:							
West Hartlepool	—	2	—	—	2	2	2
Cargo Fleet	—	2	—	—	2	2	2
TOTAL	4	16	—	1	21	21	34

Scotland.

Bairds & Scottish Steel: Gartsherrie	1	1	1	—	3	3	5
Carron	—	—	1	—	1	1	4
Colvilles: Clyde Works	—	3	—	—	3	3	3
Dixon's	—	2	—	—	2	2	6
TOTAL	1	6	2	—	9	9	18

South Wales and Monmouthshire.

Briton Ferry Works	1	—	—	—	1	1	1
Guest Keen Iron & Steel: Cardiff	1	2	—	—	3	3	4
Thomas, R., & Baldwins: Ebbw Vale	—	3	—	—	3	3	3
Steel Company of Wales: Margam	—	4	—	—	4	3.8	4
TOTAL	2	9	—	—	11	10.8	12

New ISCo Steel Foundry

The spun-pipe plant of the Indian Iron & Steel Company at Kulti in West Bengal, India, is to be augmented by a further unit, now under construction, for producing up to 27-in. pressure pipes. Some idea of the size of the group's existing foundry facilities at Kulti may be obtained from the following subdivision of output during 1955: Spun iron pipes 50,126 tons; vertically-cast pipes 15,576 tons; general iron castings 20,892 tons; light iron castings 11,498 tons and non-ferrous castings 702 tons (total 98,794 tons). The group has its own blast-furnaces and coke ovens both at Kulti and its nearby "steel town" of Burnpur, in addition to facilities for refractory-brick manufacture. Other large iron and steel foundries are operated by Burn & Company at Howrah, near Calcutta, who are in the same group.

FOR ITS MAY LUNCHEON, the Non-Ferrous Club had Mr. Sydney Bowskill, of Pickfords, Limited, as its guest speaker. Mr. Bowskill described some of the difficulties which have to be faced in the transport of heavy loads by road. In particular, he stressed the delays which occur as a result of detours made necessary by the inadequacy of bridge structures under present-day conditions. Following the luncheon a collection was taken on behalf of the Birmingham Federation of Boys' Clubs, which realized £16 16s.

Rolls-Royce Contract

An aero engine contract from Spain—the second of its kind in recent years—worth £1,000,000, is now being carried out at the Rolls-Royce works at Hillington, Glasgow. Under the contract, Hillington will supply 173 Merlin piston-engines for the Spanish Air Ministry. The first part of the order, which includes maintenance spares and tools, and complete sets of power plant installation accessories, has now been shipped to Spain.

According to the announcement, the contract "illustrates the extent to which the Scottish group is continuing the piston-engine production alongside jet engine programme—and this production is likely to go on for a long time. Piston-engine overhaul commitments extend to beyond 1959 and many of the reconditioned engines will still be in service over the next decade, though perhaps not on main routes." The statement points out that the Glasgow factories of the company are the biggest piston and jet overall bases in Europe, if not in the world.

Wadkin Chairmanship

Although Sir Holland Goddard has made a considerable recovery from his recent illness, he has decided to lighten his duties by relinquishing his executive appointments as chairman and joint managing director of Wadkin, Limited, the Leicester company which claims to be the largest manufacturers of woodworking machinery in the world, but he is remaining on the board. Sir Holland, who is chairman of the National Steel Foundry (1914), Limited, and the Imperial Typewriter Company, Limited, joined the original firm of Wadkin & Company in 1912.

He became its first governing director on its incorporation as a limited company in 1935 and in 1951, when it became a public company, he was appointed chairman and managing director. Sir Holland was vice-president of the Machine Tool Trades Association in 1945 and was elected president in 1946, continuing to hold that office during 1947 and 1948. He was knighted in 1949 for public services. To fill the vacancies thus caused in the Wadkin directorate, Mr. J. B. Bullivant, who joined the board last year, becomes chairman, and Mr. L. Austin becomes managing director.

British Blast Furnaces in the March Quarter, 1956—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast at end of the first quarter, 1956.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Goldendale Iron	—	—	1	—	1	1	2
Lilleshall	—	—	1	—	1	1	2
Round Oak Steel Works	—	—	—	—	—	—	2
Shelton Iron, Steel & Coal	—	3	—	—	3	3	3
Stewarts and Lloyds: Bilston	—	2	—	—	2	2	3
TOTAL	—	5	2	—	7	7	12
Sheffield.							
Park Gate Iron & Steel	—	2	—	—	2	2	2
GRAND TOTAL	14	61	22	4	101	101.6	138

Weekly Average Number of Furnaces in Blast during the March Quarter, 1956, and the Previous Four Quarters

District.	1955.				1956.
	March.	June.	Sept.	Dec.	March.
Derby, Leics., Notts., Northants, and Essex	26	26	24.9	25.5	25.7
Lancs. (excl. N.-W. Coast), Denbigh, Flint, and Ches.	6	5.8	6.4	6.7	7
Lincolnshire	9.9	10	10	10	10.1
North-East Coast	22	22	22	20.8	21
Scotland	9	9	9	9	9
Staffs., Shrops., Worcs., and Warwicks.	7	7	7	7.2	7
S. Wales and Monmouth	9.1	9.2	9.6	9.8	10.8
Sheffield	2	1.2	1.3	2	2
North-West Coast	7.9	7.7	7.8	9	9
TOTAL	98.9	97.9	98	100	101.6

The following companies have furnaces in course of construction or rebuilding:—Dorman Long (Steel) (2); Lancashire Steel Corporation; South Durham Steel & Iron (West Hartlepool and Cargo Fleet); Millom & Askam Hematite Iron.

New RTB Research Department

The problems which confront the steel industry are obviously not confined to those of technology and manufacture alone. Raw-materials handling, traffic dispositions, operational communications, new equipment needs, and so on all present their own difficulties and it is with this in view that Richard Thomas & Baldwins, Limited, has set up an operational research department serving all sections of the company at its Ebbw Vale works, which will, in short, seek the better utilization of existing resources.

The department will be headed by Mr. Stephen L. Cook, who is 36. He graduated from the University of London with an honours degree in engineering. During the second world war, he was a member of the Admiralty Scientific Service, and was closely concerned with minesweeping research—including degaussing of vessels against the magnetic mine. In 1946, he joined the Nelson research laboratories of the English Electric Company, Limited, at Stafford.

Two years later Mr. Cook went to the operational research group of the National Coal Board. He became deputy head of the group in 1949, and worked on problems such as the economics and safety of underground operations, routine and emergency communications, and material handling. Last year, he visited the United States to study operational research and industrial engineering methods, and during his three-months' stay lectured at a number of technological institutes.

News in Brief

THE sixth Electrical Engineers Exhibition will be held at Earls Court, London, from April 9-13, 1957.

F. & M. SUPPLIES, LIMITED, announce that Mr. J. D. Lickley has joined their organization as a technical sales representative.

THE DUTCH postal authorities have placed an order worth £20,000 with Geo. Salter & Company, Limited, West Bromwich, for 1,350 parcels balances.

WILD-BARFIELD ELECTRICAL FURNACES, LIMITED, announce the removal of their applied high-frequency division to Elecfurn Works, Watford By-pass, Watford, on May 28.

A SECOND ORDER, worth US$1,000,000, has been received from Colombia by W. T. Henley's Telegraph Works Company, Limited, for cables for the Bogota Telephone Company.

As from Monday the address of the market development department of the British Iron and Steel Federation will be Steel House, Tothill Street, London, S.W.1 (telephone: WHItehall 1030).

THE Federation of Light Metal Smelters announces that its members' average selling prices for March (calculated to the nearest 10s.) were:—LM1, £193 10s. per ton; LM2, £194; LM4, £199 10s.; LM6, £206.

THE GOVERNOR-GENERAL of the Federation of Rhodesia and Nyasaland, Lord Llewellin, opened the concentrating plant at Chibuluma, the newest mine of the Rhodesian Selection Trust group of companies in the Copperbelt of Northern Rhodesia, on May 5.

THE TRACTOR DIVISION of David Brown & Sons (Huddersfield), Limited, has ended short-time working. It had affected 1,200 men—900 at Meltham, Huddersfield, and 300 at Farsley, Leeds. A four-day week has been operating for nine weeks. There has been an all-round improvement in both home and overseas trade since the restriction.

DAVID BROWN MACHINE TOOL DIVISION is to exhibit seven completely new types of gear-cutting tools at the International Machine Tool Exhibition to be held at Olympia towards the end of June. One of these is claimed to be the fastest of its kind in the world. There are already orders worth £350,000 for it from the United Kingdom, France and Italy.

CONTRACTS for 10 ships with a value exceeding £5,500,000 are announced by the Burntisland Shipbuilding group of companies, which comprises the Burntisland Shipbuilding Company, Limited, Hall, Russell & Company, Limited, Aberdeen, and Alexander Hall & Company, Limited, Aberdeen. The 10 ships have a deadweight tonnage of 68,570 tons.

IN HIS CAPACITY as chairman of the Northern Ireland Development Council, Lord Chandos is leaving London for New York on May 22, and will meet British and American Government officials and leading US industrialists to explore how best the Council can locate and approach American concerns which might be interested in setting up plants in Ulster.

STEEL, PEECH AND TOZER, of Rotherham, a branch of the United Steel Companies, Limited, are spending £180,000 on a new cold-rolling mill and associated annealing equipment, which will enable output of narrow-steel strip for the strapping, tube and bicycle industries to be stepped up by about 50 per cent. The increase has already been fully allocated to customers.

INTERNATIONAL HARVESTERS COMPANY OF GREAT BRITAIN plans to increase the number of workers at its factory at Idle, Bradford, from 700 to 1,000 (or possibly 1,200). The firm took over the plant, formerly owned by the makers of Jowett cars, in July, 1954. A big shipment of agricultural machines is to be sent in July to Australia, to which exports have just begun after two years' production.

SPEAKING at the last official luncheon of the Castle Bromwich BIF before it closed on May 4, Mr. E. M. Clayson, president of the Birmingham Chamber of Commerce, sharply criticized some of the sales staff for their "couldn't care less" attitude. He said that when distinguished visitors were shown round, some of the salesmen "did not even bother to leave their cubby holes at the back of the stands."

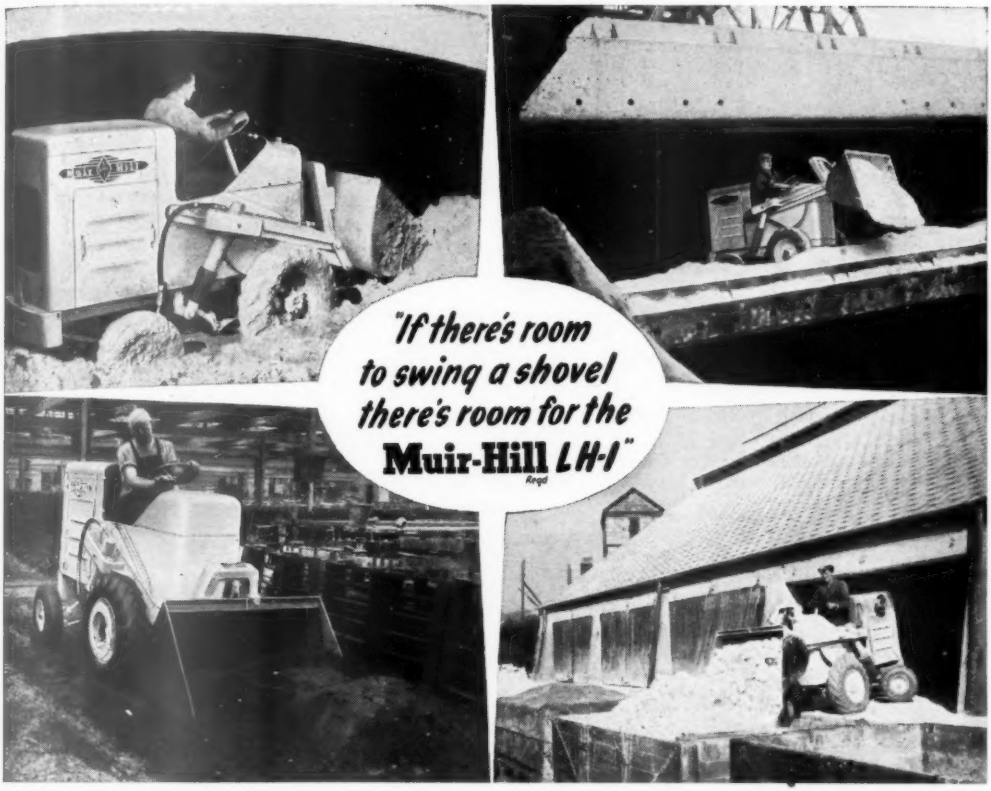
INFORMATION received from the S.G. Iron Producers' Association is to the effect that the production of this quality of iron was, in this country in 1955, 86 per cent. greater than in 1954. This increase is higher than the general world increase, but much leeway has to be made up before output attains that now being made in certain Continental countries. The Association now has 35 members, representing 97 per cent. of the active producers.

POLYGRAM CASTING COMPANY, LIMITED, Power Road, Gunnersbury, London, W.4, announce that they are showing a colour film on shell moulding, complete with sound, of half-an-hour's duration, at the following towns: Birmingham, Queen's Hotel, June 5; Sheffield, Grand Hotel, June 6; and Manchester, Midland Hotel, June 7. On each occasion showing is to start at 7 p.m. Local foundrymen are cordially invited to attend and participate in the discussion.

THE PLANT ENGINEERING DIVISION of the British Iron and Steel Research Association will hold its 13th conference in Sheffield on July 3 and 4, on the theme of "Works Transport." The main emphasis will be on road-transport methods and demonstrations of various types of vehicles are being arranged. Further particulars and details of the arrangements for the conference may be obtained from the technical secretary, plant engineering division, BISRA, 140, Battersea Park Road, London, S.W.11.

A SCHEME to set up a hydro-electric project, involving a programme costing about $250,000,000 (about £90,000,000), on the Peribonka River in Northern Quebec, Canada, was announced at the annual meeting of Aluminium, Limited, in Montreal, by the company's president, Mr. Nathanael V. Davis. Assuming both the new Quebec expansion and the construction programme at Kitimat, British Columbia, were advanced without delay, he said, the company's Canadian aluminium capacity would be increased from 650,000 tons at the end of 1955 to over 1,000,000 tons at the end of 1959.

SPEAKING at the annual banquet of the Birmingham Chamber of Commerce last month, the Minister of Supply warned industrialists that they would meet growing competition from Russia in overseas markets and described Soviet technological advance as "about the most important factor on the international scene at the moment." He said: "They are building up a corps of technological experts in every field who are of a very high standard, and are more numerous than our own technologists. And when the standards are about the same, it is those who can throw the most brains into the struggle who will get results first." The Lord Mayor of Birmingham, Ald. A. L. Gibson, said he could not understand why, at a time when foreign competition was at its most serious, the Government had decided to put up the shutters on so important a shop window of British industry as the London section of the British Industries Fair.



The Muir-Hill LH-1 is a compact, highly manoeuvrable diesel-powered loader with the unique advantage of bringing bulk material handling in confined areas out of the hand shovel into the mobile power loading class.

6ft. 6in. working ceiling, 7ft. 6in. turning radius, 4ft. 3in. width—consider these dimensions in relation to those awkward places where you have never before been able to employ any form of mechanisation—and then ask us to send you further details on the LH-1.

It does not matter what material you are handling, the LH-1 has the right bucket for the job, with a range of 14.5, 10.5 and 6.5 cu. ft. capacities, a special ore bucket and a fork lift attachment of 1,000 lbs. rated capacity with evenly distributed loads.

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Personal

VISCOUNT CHANDOS, D.S.O., has been re-elected president of the British Electrical Development Association for the year 1956/7.

COLONEL CHARLES RALPH HODGSON, a director of C. & J. Hampton, Limited, tool makers, Bernard Road, and Record Tool Works, Sheffield, became president of Sheffield Chamber of Commerce at their annual meeting on Wednesday, May 2.

Mr. FRANK HOLMES has been appointed chief purchasing officer to Hadfields, Limited, steelmakers, Sheffield. He succeeds Mr. J. E. GUEST, who has been with Hadfields since 1934, and who is being released to take up special duties before retirement.

SIR RONALD MATTHEWS is to retire from the chairmanship of the Brush Group, Limited, after the annual general meeting on May 17. For many years now he has been a prominent personality in the heavy industrial field, and also it was only just over a year ago that his appointment was announced as deputy chairman of the Independent Television Authority.

Mr. THOMAS POWELL, ASSOC.MET., F.I.M., has been appointed managing director of British Acheson Electrodes, Limited, in succession to Mr. W. B. H. GALLWEY, who was recently appointed chairman of the company. Mr. Powell, who is 47 years of age, is divisional managing director of British Electro Metallurgical Company (a division of Union Carbide, Limited), and also a director of Union Carbide, Limited.

Mr. W. R. P. KING, works manager of The Mint, Birmingham, has been appointed a director of the company in succession to Mr. W. E. JUDGE. He joined the Mint as a departmental manager in 1935; was appointed assistant works manager in 1940, and works manager in 1944. He was chairman of the Birmingham branch of the Institution of Works Managers from 1946 to 1949, and was elected a Fellow of the Institution in 1949.

Mr. W. LINDSAY BURNS, managing director of Henry Balfour & Company, Limited, Durie Foundry, Leven, Fife, has retired. Directors and staff entertained him to dinner, when Mr. and Mrs. Burns were made the recipients of presentations. Mr. Burns has been managing director of the firm for over 25 years, and is to continue as chairman of the company. His son, Mr. LINDSAY BURNS, JUN., and Mr. I. M. O. HUTCHISON succeed him as joint managing directors.

Mr. W. W. BRAIDWOOD, of the Development & Research Department of the Mond Nickel Company, Limited, is taking part in the annual congress of the American Foundrymen's Society at Atlantic City and, while in America, will address a meeting of licensed producers of s.-g. iron there on the latest developments with the material in Europe. Mr. Braidwood will also be visiting a number of iron foundries in America before returning to this country early in June.

Obituary

Mr. WILLIAM H. BUCHANAN, former general manager of R. & H. Green & Silley Weir, Limited, ship engine and boiler repairers, etc., of London, E.C.3, died on April 29.

The death has occurred of Mr. DENNIS WARD BENNETT, works director of Webster & Bennett, Limited, machine-tool makers, of Coventry. Before joining the company in 1920, Mr. Bennett was associated with Gimson & Company (Leicester), Limited, engineers and ironfounders. He was 57.

Physical Society Exhibition

The annual exhibition of the Physical Society takes place again this year in the Royal Horticultal Society's old and new halls, from May 14 to 17.

AMONG the exhibitors will be Edwards High Vacuum, Limited, Manor Royal, Crawley, Sussex, with a display of high vacuum rotary and vapour pumps; gauges; coating plant; and high vacuum accessories, the latter including butterfly valves.

BRITISH IRON AND STEEL RESEARCH ASSOCIATION will exhibit a furnace-scanning periscope; suction pyrometer; pyrometric periscope; and an instrument which has been developed for the detection of lamination in metallic sheet.

EQUIPMENT to be exhibited by the Baldwin Instrument Company, Limited, Brooklands Works, Dartford, includes a gamma-ray back-scatter thickness-gauge, to measure the thickness of metals, where only one side is accessible; a transmission densitometer with colour filters for measuring the densities of photographic negatives and transparencies, plastics, X-ray film, etc.; and a gamma-ray hopper-level controller.

ON SHOW at the stand of Kelvin Hughes, Limited, will be a supersonic depth and thickness gauge M.K.2, designed for use with supersonic floor detectors; a high-power transmitter; induction motor-generator designed for 400 c/s servo applications; a pressure transducer with power output; and a miniature slip-ring system, intended primarily for use in gyroscopes and other small electro-mechanical devices.

THE STAND of the Morgan Crucible Company, Limited, Battersea Church Road, London, S.W.11, will feature some of the developments which have originated from their central research department. Included amongst these is a mercury porosimeter; microscope hot-stage (the latter consisting of a fine thermocouple used in an element heated by audio power, with the d.c. thermo e.m.f. used for the temperature measurement); Crusilite—M.I.28 laboratory furnace; and I.C. silicon carbide and metal/ceramic (Metamic) bodies. These materials have been developed to operate as from 1,200 to 1,400 deg. C. without deformation and to withstand sudden changes of temperature, such as for thermocouple protection-sheaths for quick immersion temperature readings in molten metals; high-temperature bearings, etc.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BIRMINGHAM, May 16—300 cast-iron street-lighting columns in the year commencing July 1, 1956, for the public works committee of the City Council. The City Engineer and Surveyor, Civic Centre, Birmingham, 1.

NOTTINGHAM, May 23—Cast-iron pipes, special castings, irregular special castings, miscellaneous iron castings, sluice valves and hydrants, and gunmetal fittings, for the 12 months ending June 30, 1957, for the City Council. Mr. B. N. Davies, engineer and general manager, Water Department, Castle Boulevard, Nottingham.

AUSTRALIA, June 26—Supply and installation of pumping machinery, for the Public Works Department, Perth, Western Australia. (ESB/10585/56.)

BURMA, May 16—Centrifugal pump and air compressors, for the Chief Controller, Union of Burma Purchase Board, Rangoon. (ESB/11287/56.)

INDIA, May 29—Overhead travelling crane, for the Director-General of Supplies and Disposals, Government of India. (ESB/11201/56.)

TWW

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F5/29

Mechanical Handling Exhibition

At the Mechanical Handling Exhibition which opened yesterday at Earls Court, London, the following firms are among the exhibitors. (Other particulars were published in last week's issue.)

DIESEL ENGINES featured by F. Perkins, Limited, Oldbury, Nr. Birmingham, on stand No. 257, range from 125 b.h.p. at 2,200 r.p.m. downwards. A 45-b.h.p. model is sectioned for inspection.

MECHANICAL HANDLING EQUIPMENT on stand No. E.128 of J. Collis & Sons, Limited, Grays Inn Road, London, W.C.1, includes hydraulic and other trucks; roller motorized conveyors; and platforms.

ONE OF THE PRINCIPAL EXHIBITS of the National Gas & Oil Engine Company, Limited (stand No. 16), is the "M4AA6" type, 6-cylinder vertical diesel-engine, supplying 198 b.h.p. at 1,200 r.p.m.

BROCKHOUSE ENGINEERING (SOUTHPORT), LIMITED, Rufford Road, Crossens, Southport, are showing, on stand No. 234, a sectional torque-converter and transmission unit, representative of the range which they manufacture for the industrial field, suitable for engines from 16 to 1,000 h.p.

EXHIBITS of the Dunlop Rubber Company, Limited (stand No. 81), include conveyor, transmission (flat or V), and elevator belting for general industrial use; flexible pipes for high-, medium- and low-pressure hydraulic or pneumatic services; and containers of all kinds made from Fortiflex a new rubber/resin compound.

THE STAND of International Combustion Products, Limited, 19, Woburn Place, London, W.C.1 (No. 51), is devoted to coal and bulk handling plant. Exhibits include a working gravity bucket conveyor installation; Vacseal pumps for handling abrasive materials and requiring no sealing water; also a Hardinge constant weight feeder, and Syntron electric vibratory equipment.

PETTERS, LIMITED, Causeway Works, Staines, Middlesex (stand No. 16), are displaying air-and water-cooled engines from 1½ to 19 b.h.p., including a Pazi single-cylinder air-cooled diesel of 1½ to 3 b.h.p. at 1,000 to 1,800 r.p.m.; Petter-Reavel AV2C water-cooled diesel-engine compressor; and AVA2T air-cooled diesel traction-type engine developing 6 to 12 b.h.p. at 1,000 to 1,800 r.p.m.

AMONG a number of new and improved products which are on display at the stand (No. 25) of the British Tyre & Rubber Company, Limited, is a range of hot-material belts suitable for a variety of loads, conditions and temperatures; a heavy-duty impact idler incorporating rubber-in-shear; a plastics hose consisting of a P.V.C. cover and lining fused on to a synthetic reinforcing fabric; and transmission-belting and air-ducting equipment.

A FULL RANGE of conveyors is being shown by Paterson Hughes Engineering Company, Limited (stand No. 99), including some foundry applications. A major advance towards automation is represented by the "Greer" palletizer seen for the first time in this country. This unit is capable of placing up to 1,800 cartons, crates or sacks per hour on pallets, and has taken the place of manual work in placing goods on the pallets.

AN ENTIRELY NEW diesel-powered truck—the LD auto-truck—is being shown by R. A. Lister & Company, Limited, of Dursley. Light in weight, highly manœuvrable, yet easily handled, the truck is driven by a 3½-h.p. air-cooled diesel engine; maximum load is 2,000 lbs., and the platform has a loading area of 17½ sq. ft. A towing attachment may be fitted to the rear of the chassis to enable the truck to haul a trailer under suitable conditions.

THE YALE & TOWNE MANUFACTURING COMPANY occupy two stands, Nos. 98 and 240, for the display of a large range of electric industrial trucks in capacities from ¾ to 3½ tons. A new addition to the series is the Platform Warehouser, a low-lift truck of 2-tons capacity designed to move loads at high speeds in congested areas. A feature of this is the "dead-man" control which cuts off the power and applies the brakes when the operator steps off the truck. Hand-lift trucks and hoists are also on show.

E. BOYDELL & COMPANY, LIMITED, of Elsinore Road, Old Trafford, Manchester, are this year exhibiting the following four Muir-Hill machines from their range of bulk materials-handling equipment on stand No. 130: A hydraulic loader of 1 cub. yd. capacity, with patent suspension system, and a smaller unit with 10.5 cub. ft. capacity, specially designed for working in confined spaces; a shunter with capacity to move 180 tons of loaded railway stock; and the gravity-tipping dumper with patent rotating seat and steering.

A NEW PRODUCT being exhibited by Ransomes Sims & Jefferies, Limited, Orwell Works, Ipswich, is the ITW industrial tractor, which is an adaptation of the MG crawler tractor. A lightweight machine, it combines the advantages of a track tractor and of a wheeled vehicle; steering calls for no more than finger-tip pressure, and the tractor is easy to manœuvre even in restricted and difficult areas. Also on stand No. 87 the firm displays a representative selection from their range of battery-powered industrial trucks.

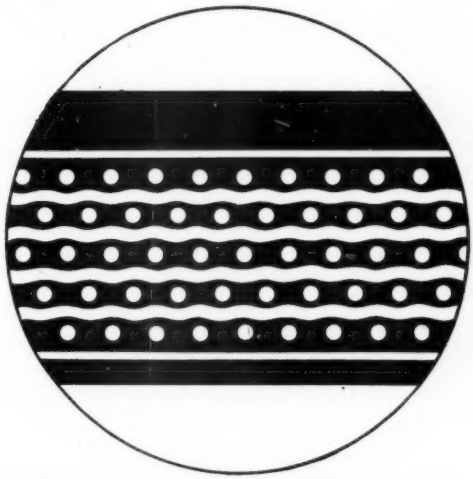
ON STAND No. 22 the British Straddle Carrier Company, Limited, 7, Chesterfield Gardens, London, W.1, are showing their latest diesel model, the Steelmaster Mark 1A, which is fitted with a new-type straddle carrier of 30 cwt. maximum capacity. The unit is self-loading and unloading and travels at a speed of 25 m.p.h. forward or reverse. The length of the loads can be up to 60 ft. and the average working load recommended by the makers is 7 tons. Demonstrations will be given outside the Hall at intervals daily.

International Conference on Fatigue

Sponsored by the Institution of Mechanical Engineers, in co-operation with the American Society of Mechanical Engineers, an international conference on the fatigue of metals has been arranged to take place in London from September 10 to 14, and in New York from November 28 to 30. The opening of the conference (Central Hall, Westminster) will be by the president, Mr. T. A. Crowe, M.Sc. After that, at the technical sessions in the Institution (where about 400 can be accommodated) some 70 technical papers are so far listed for presentation—the subjects ranging as far apart as the effect of shot-peening propeller blades to the fatigue of automobiles. The closing session will also be at the Central Hall. Most of the papers will, it is understood, be preprinted and presented in abstract at the sessions by reporters, leaving maximum time for discussion.

It is planned also to arrange visits to centres at which research on fatigue of metals and metal components is being conducted, these will take place from September 17 to 21. Full details of the conference, registration fees, etc., together with a reply-form for applying to attend will be available in due course from the Institution of Mechanical Engineers, 1, Birdcage Walk, Westminster, London, S.W.1.

Focus on conveyor belting proves Goodyear superiority



There is obviously only one way of proving to yourself beyond any doubt that Goodyear conveyor belting gives long and reliable service. That's by installing it.

But for proof in advance there's the record of efficiency of Goodyear conveyor belts in thousands of existing installations in this country—in steelworks, power stations, mines, quarries, factories and foundries.

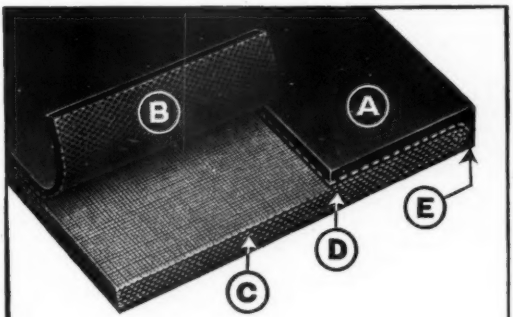
At a big steelworks, for instance, Goodyear belts conveying hot sinter are lasting over twice as long as other makes previously used.

QUICK PROOF

Focus on conveyor belting proves Goodyear superiority, and quickly confirms that Goodyear belting makes every conveying job an economic proposition.

The emphasis is on *every*. Whatever the conveying work, there's a "job-designed" Goodyear belt to do it at the lowest cost per ton.

This cost-saving is ensured by the exceptionally high quality built into every Goodyear belt. And this quality is ensured by rigid adherence to raw material specifications and stage by stage production inspection.



RUGGED CONSTRUCTION OF GOODYEAR BELTING

A Tough, heavy-duty cover compounded to suit job.
B Breaker fabric to improve bond between cover and carcass—when required.
C Plies of close-woven duck, inhibited against mildew.
D Skim coat between plies prevents separation.
E Rugged edge cover resists wear.

QUICK DELIVERY

You can now get quick delivery of Goodyear conveyor belts, which are available with cotton or rayon carcass in any width up to 72 inches. They can be supplied in a few weeks against specific ordering.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

CONVEYOR BELTING · TRANSMISSION BELTING · V-BELTS · INDUSTRIAL HOSE

Raw Material Markets

Iron and Steel

Higher prices for iron and steel had been expected for a long time and the changes which took effect on Monday occasioned no surprise. They followed closely on an advance in the scrap prices, authorized by the Board of Trade, which came into operation on May 4. But the fact that the advances were expected—even inevitable—does not make them any more palatable to ironfounders. In some branches of the foundry industry orders are come by none too easily and the increase in costs will further handicap efforts to secure work.

Over the whole range of iron and steel products the average increase is 5 per cent. Foundry pig-iron is up 10s., basic pig-iron 15s., and hematite 25s. The average increase in scrap prices is 40s. a ton.

The further expansion of steel production is very largely governed by the provision of more basic pig-iron, and some improvement in this direction is now foreshadowed as a result of changes in Derbyshire, where blast furnaces have been transferred from high-phosphorus to basic-iron production. It is not expected that the light foundries will be inconvenienced, as supplies of No. 3 iron have recently been running in excess of requirements, but it will probably affect export sales.

Engineering foundries are still very busy and current deliveries of hematite and low-phosphorus iron are barely sufficient for their requirements.

One outcome of the rising production of crude steel is that British steelmakers have been enabled to provide bigger tonnages of semi-finished steel in the form of billets, blooms, and slabs, and in turn these ampler supplies have ensured regular operation of the re-rolling mills. There are still many complaints of the lack of finished-steel products and delayed deliveries, but the position is certainly much easier than it was a few months ago, and progressive improvement is promised.

Non-ferrous Metals

Now that in the United States the Custom smelters' price, at 45 cents a pound, has fallen below the producers' quotation of 46 cents there may well be some pressure on the latter to lower their level. This situation has come about largely because production and demand are rapidly getting into balance and consumption is generally lower.

The copper industry, too, has been free from strikes, but, before making any decision on the lowering of prices, producers will cast a wary eye on the immediate future. Labour contracts of the big four primary producers in the States expire at the end of next month and the men are demanding a wage increase of 20 cents an hour, fringe benefits, and unemployment pay of $60 per week throughout the year. If these are granted and consumption of copper remains at its present level, the US copper price will hardly go much lower and may well initiate a higher price trend.

In London, demand for copper at the lower levels has been fairly good, but on the New York market trading is light at the 45-cent level.

Tin continues to fluctuate within narrow limits. Demand is only fair and the backwardation is negligible. In New York metal is changing hands at around 97¼ cents a pound for spot and June metal is offered at 96¼ cents.

Demand for lead, although good at times, has been uneven. In the States, trading is moderate at 16 cents a pound and the industry believes that a strengthening demand will appear before there is any necessity to reduce the price.

Zinc consumption is good both here and in the US, where increased activity in house construction and an expected increase in industrial expansion would appear to be bolstering demand.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* May 3, £346 10s. to £347; May 4, £340 to £341; May 7, £338 to £338 10s.; May 8, £352 to £353; May 9, £349 10s. to £350.

Three Months: May 3, £341 10s. to £342; May 4, £333 10s. to £334; May 7, £331 10s. to £332; May 8, £345 to £345 10s.; May 9, £341 to £342.

TIN, Standard—*Cash:* May 3, £755 to £757; May 4, £751 10s. to £752 10s.; May 7, £750 10s. to £751; May 8, £752 to £753; May 9, £754 to £755.

Three Months: May 3, £752 to £754; May 4, £748 10s. to £749; May 7, £748 to £749; May 8, £750 to £751; May 9, £752 to £753.

LEAD—*First half May:* May 3, £111 10s. to £111 15s.; May 4, £111 to £111 5s.; May 7, £110 10s. to £110 15s.; May 8, £110 10s. to £110 15s.; May 9, £110 10s. to £110 15s.

First half August: May 3, £111 to £111 5s.; May 4, £110 5s. to £110 10s.; May 7, £110 to £110 5s.; May 8, £109 10s. to £109 15s.; May 9, £109 10s. to £109 15s.

ZINC—*First half May:* May 3, £96 10s. to £96 15s.; May 4, £96 10s. to £96 15s.; May 7, £96 to £96 5s.; May 8, £95 10s. to £95 15s.; May 9, £95 10s. to £95 15s.

First half August: May 3, £95 5s. to £95 10s.; May 4, £95 to £95 5s.; May 7, £94 10s. to £94 15s.; May 8, £94 5s. to £94 10s.; May 9, £94 to £94 5s.

Iron-ore Imports

Iron-ore imports in March, and the total for the first three months of this year compared with the corresponding period of 1955, are shown below.

Destination.	Month ended March 31.	Three months ended March 31.	
	1956.	1955.	1956.
	Tons.	Tons.	Tons.
Sierra Leone	52,020	153,900	153,400
Canada	—	80,011	165,469
Other Commonwealth countries and Eire	1,251	4,500	4,377
Sweden	203,877	843,836	878,807
Norway	6,325	13,166	22,819
Western Germany	—	14,392	2,917
France	57,531	148,079	160,222
Portugal	8,684	15,593	23,389
Spain	47,691	144,991	183,514
Algeria	109,884	532,421	364,269
Tunisia	75,455	148,664	216,000
French Morocco	36,424	60,876	100,576
French West Africa	59,458	111,125	194,514
Spanish Morocco	8,275	40,730	68,245
Liberia	40,370	66,411	78,930
Brazil	39,500	81,615	137,500
Other foreign countries	25,535	17,521	111,932
TOTAL	772,280	2,477,831	2,866,880

THE BUREAU INTERNATIONAL DE LA RECUPERATION announces that the annual congress is to be held in Düsseldorf from May 16 to 18.